# CAPE OF GOOD HOPE.

DEPARTMENT OF AGRICULTURE.

# MARINE INVESTIGATIONS

IN

# SOUTH AFRICA.

VOLUME II.

*WITH FORTY PLATES.*



CAPE TOWN:

THE CAPE TIMES, LIMITED, GOVERNMENT PRINTERS.

1904

D6150.

CONTENTS.

# SOUTH AFRICAN CRUSTACEA.

## PART II.

BY THE

REV. THOMAS R. R. STEBBING,

M.A., F.R.S., F.L.S., F.Z.S.

During the last two or three years Dr. Gilchrist's "Marine Investigations" have produced a very copious supply of crustaceans, and for the very highly satisfactory state in which the specimens have reached England he wishes me to recognize the valuable assistance he has received from Captain Turbyne. In this second instalment of my report several species are figured and described which claim the interest of being new to science. Others have been treated with more or less fulness of detail in order to establish or discuss their identity with forms already named by earlier authorities. This treatment seems especially requisite whenever a species is assigned to a locality distant from its previously known range. It certainly involves much repetition in the literature of natural history, but without it questions of distribution may be completely confused by the list of a local fauna. All depends on the sometimes shadowy guarantee of the compiler's credit. In the present report the point which has the best right to engage attention is, I venture to think, the rapidly accumulating evidence that, at least in regard to Crustacea, the marine fauna of South Africa stretches forth its hands both to the east and to the west, or rather, swings them round to all points of the compass. Those species which it claims for its own make often a very close approach to oriental and occidental forms which in some cases have hitherto been known only from distant localities. In some instances a South African form is to all appearance quite indistinguishable from a European or other far-off species, but future research may show that the interval is bridged by many intermediate stations. That some forms vary considerably in the captures of a single dredging, while others seem to remain constant over a vast range, adds considerably to the responsibility of specific determination. This difference of conditions, however, may be explained as more apparent than real. Species that are gregarious and so get taken in large family groups, display conspicuously the variations of

sex and age, which court little attention in others that from their great size or their habits of life are, as a rule, taken one by one.

## CRUSTACEA MALACOSTRACA.

### BRACHYURA GENUINA.

1841. *Brachyura*, de Haan, Crustacea Japonica, decas quinta, p. 112.
1880. *Brachyura genuina*, Boas, Studier over Decapodernes Slaegtskabforhold, p. 138.
1899. *Brachyura genuina*, A. Milne-Edwards and Bouvier, Crust. Décap. Hirondelle et Princesse-Alice, Monaco, fasc. 13, pp. 3, 15.
1899. *Brachyura vera*, Alcock, Deep-sea Brachyura R.I.M.S.S. Investigator, p. 39.
1900. *Brachyura genuina*, A. Milne-Edwards and Bouvier, Crust. Déc. du Travailleur et du Talisman, p. 21.

The genuine Brachyura as distinguished from the Brachyura Anomala include four divisions—the Oxyrrhyncha, Cyclometopa, Catometopa, and Oxystomata—the family Raninidae being included in the last of the four.

### OXYRRHYNCHA.

### FAM.: MAIIDAE.

1895. *Maiidae*, Alcock, Journ. Asiat. Soc. Bengal, vol. 64, pt. 2, p. 160.
1899. *Maiidae*, Alcock, Deep-sea Brachyura Investigator, p. 39.
1900. *Maiidae*, M. J. Rathbun, The American Naturalist, vol. 34, p. 504.

This family is sometimes sub-divided into the Inachidae, the Maiidae, and the Periceridae. Of the two genera here noticed, Alcock places *Platymaia* in a sub-family Inachinae, and *Scyramathia* in a sub-family Pisinae. Since *Pisa*, Leach, is a synonym of the same author's *Blastus*, Pisinae, if upheld, would become Blastinae, or, as a family, Blastidae.

### GEN.: PLATYMAIA, Miers.

1886. *Platymaia*, Miers, Challenger Brachyura, Reports, vol. 17, p. 12.
1893. *Platymaia*, Stebbing, History of Crustacea, Internat. Sci. Ser., vol. 74, p. 110.

1895. *Platymaia,* Alcock, Journ. Asiat. Soc. Bengal, vol. 64, pt. 2, p. 180.

1899. *Platymaia,* Alcock, Deep-sea Brachyura of R.I.M.S.S. Investigator, p. 45.

Carapace suborbicular. Rostrum tridentate. No preocular spine, but a post-ocular spine against which the eye is retractile, but which affords no concealment to the eye. Eyes large, with short eye-stalks. Epitome small, transverse. Basal antennal joint short, cylindrical, free; the flagellum and part of the peduncle visible from above. Third maxillipeds with the fourth joint narrow, and bearing the next joint at its summit. Chelipeds in the adult male long, with a long inflated club-shaped palm; in the female, short and slender. Ambulatory legs long, some of them spiny, fingers of the hinder pairs compressed. Pleon in both sexes with all the segments separate.

The above definition is borrowed from Alcock, with some modifications to suit the new species here described. The account of the chelipeds in the adult male still, however, rests only on the type species, *Platymaia wyvillethomsoni,* Miers, of which a magnificent male specimen is figured by Alcock and Anderson, in the Illustrations of the Zoology of the R.I.M.S.S. Investigator, Crustacea, pl. 16, 1896. In that species both sexes have the penultimate joint in the last three pairs of legs somewhat dilated and compressed, but there is no dilatation worthy of remark in the corresponding part of the new species.

## Platymaia turbynei, n. sp.

### Plate 5.

The type species of the genus was dredged by the "Challenger" north of the Admiralty Islands, and by the "Investigator" in the Andaman Sea. More recently the "Valdivia" procured it rather plentifully at the Nicobar Islands (Chun, Aus den Tiefen des Weltmeeres, pp. 396, 370, fig. in text). Accordingly, notwithstanding the differences between the sexes and between the younger and older stages pointed out by Major Alcock, the figures by several independent observers show that its general configuration is fairly constant. The new African species agrees with it in too many points to admit of generic separation, though specifically it is very obviously distinct.

The distinguishing marks are the prolongation of the central spine of the depressed and then upward turned rostrum much in advance of the two lateral spines; the shape of the carapace, which has the hind margin much more broadly rounded; the proportion of the ambulatory legs to one another, the proportions of their joints, and the shape of the penultimate joint in the hinder limbs.

The middle spine of the rostrum forms a considerable angle below with the inter-antennulary septum. The most conspicuous spines of the carapace in dorsal view, beside those of the rostrum and the pair that flank the eyes, are three spaced about the middle of each side and two longitudinally placed at about the middle of the back. These have a pair transversely placed behind them and three pairs strongly diverging from before backward on either side of them. Behind the rostrum six small spines stretch across the carapace in a shallow curve. There are others round the hind margin, and a few minute prickles occur in various parts. The sternal plastron has rather conspicuous prickles across the centre in the three middle divisions. The first segment of the pleon is square, with concave sides, the next two are the widest, the fourth narrows to the fifth, which is the same width as the longer sixth and almost semi-circular seventh. From the shape of the narrow pleon and the small size of the chelipeds it may be surmised that the specimens at present at command are young males.

The eyes in formalin are reddish brown.

The second antennae readily fold back. The slender flagellum is longer than the peduncle.

The third maxillipeds agree with Alcock's description of those in the other species. The third joint is greatly broader than the fourth, the seventh is longer than either the fifth or the sixth. All these joints are spinose, the third and fourth having on the surface and at the outer margin rows of denticles in addition to their numerous slender spines.

The chelipeds are much shorter, but not (as in female and young male of *P. wyvillethomsoni*) more slender than the other legs. They are very spinose, having the fifth joint short, the sixth rather long, with the trunk subequal in length to the finger, which fits closely over the thumb, their finely denticulate margins fitting one into the other. The second legs are between two and three times as long as the chelipeds, with the spinose finger which should perhaps be included among the characters of the genus. The penultimate joint has the long spines on the inner margin, which are also characteristic in both species. This joint is compressed and somewhat dilated, though not at the two extremities. Like the two preceding joints, it is spiny on both margins. It is about three-fourths of the length of the fourth joint, which is about twice as long as the finger. The third pair of legs are much longer but far less spiny, with similar proportions between the joints, except that the sixth, which widens a little distally, rather more nearly approaches the length of the fourth. The fourth pair have the spiny armature inconspicuous, but are furnished with two rows of long plumose setæ on the inner margin of the fifth and sixth joints, and for some way along the finger. They

are longer than the third pair by reason of having their fifth joint as long as the fourth. The fifth pair are scarcely at all spiny, but setose like the fourth, and in length subequal to the third, having their fourth and fifth joints slightly shorter and the sixth a little longer than the corresponding joints in that pair.

The limbs, as preserved, are pale, with broad orange bands.

Size: The specimen figured in dorsal view measures 31 mm. from tip of rostrum to hind margin, with a breadth of 26.5 mm. just below the lowest of the three lateral spines. The second specimen figured was rather smaller. A third is a little larger.

Locality: Cape Natal N. by E. (approx.) 24 miles. Depth, 440 fathoms. Bottom, mud.

The specific name is given in token of regard for Captain Turbyne, whose valuable services, first on board the "Medusa," then at the Marine Station, Granton, Edinburgh, subsequently at the Millport Marine Station, and of late years at the Cape, have been highly appreciated by all concerned with marine zoology.

GEN.: SCYRAMATHIA, A. Milne-Edwards.

1880. *Scyramathia*, A. Milne-Edwards, Bull. Mus. Comp. Zoöl. Harvard, vol. 8, p. 311.
1881. *Scyramathia*, A. Milne-Edwards, C. R. Acad. Sci, 5 déc. 1881.
1885. *Scyramathia*, Sars, Norwegian North-Atlantic Exp., Crustacea, pt. 1, p. 6.
1887. *Anamathia*, (part) S. I. Smith, Rep. U.S. Fish. Comm. for 1885, p. 625 (21).
1889. *Anamathia*, Pocock, Ann. Nat. Hist., Ser. 6, vol. 4, p. 425.
1893. *Scyramathia*, Stebbing, History of Crustacea, Internat. Sci. Ser., vol. 74, p. 119.
1894. *Scyramathia*, Milne-Edwards and Bouvier, Camp. Sci. Prince de Monaco, fasc. 7, p. 12.
1894. *Anamathia* (part), M. J. Rathbun, Proc. U.S. Mus., vol. 17, p. 61.
1895. *Anamathia* (part), Faxon, Mem. Mus. Comp Zoöl. Harvard, vol. 18, p. 8.
1895. *Scyramathia*, Alcock, Journ. Asiat. Soc. Bengal, vol. 64, pt. 2, p. 200.
1899. *Scyramathia*, M.-Edwards and Bouvier, Camp. Sci., Prince de Monaco, fasc. 13, p. 43.
1899. *Scyramathia*, Alcock, Deep-sea Brachyura of Investigator, p. 51.
1900. *Scyramathia*, M.-Edwards and Bouvier, Exp. du Travailleur et du Talisman, Crust. Déc., pt. 1, p. 131.

In their latest work, Milne-Edwards and Bouvier define the genus as follows:—

"As in *Anamathia* the rostral horns are two; they are long and divergent, but at their base there is a supra-orbital spine which in *Anamathia* is wanting, and the orbital region offers special characters. The orbit is more complete than in the Crustacea of the neighbouring groups, and the eye is retractile hiding in a groove left between the carapace and a flattened projection behind the orbit. The basal joint of the external antennae is unarmed, and juts out a little so as to form a sort of orbital platform; it is flattened below; the movable portion of the antennae at its insertion is partially concealed under the rostrum, of which, being short, it does not reach the apex. The carapace is piriform, and its salient parts generally form flattened protuberances, which are somewhat analogous to the fungiform productions of the body in the genus *Eurynome*. The external maxillipeds are remarkable for the rounded form of the antero-external angle of the fourth joint, the opposite angle being truncate to receive the articulation of the palp.* The feet are long and strong, the fingers of the chela are sharp. The first ambulatory foot reaches beyond the others; its joints are cylindrical, and end in a finger slightly curved and apically acute. The pleon has seven segments, and is without spines; in the male the seventh segment is narrow and attenuate at the end; in the female it is very broad. The branchiæ and the appendages are of the normal oxyrrhynchal type.

The authors of this definition assign to the genus only *Scyramathia carpenteri* (Norman) and *Scyramathia occidentalis* (Faxon). They do not agree with Faxon in placing these species in *Anamathia*, because the type of the latter, *A. rissoana* (Roux), 'is well characterized by its small orbits, with upper margin entire, and without pre-orbital and post-orbital spines. They remark that the American species of *Anamathia*, *A. hystrix* (Stimpson), *A. crassa*, A. M.-Edw. (including A. agassizi, S. I. Smith). *A. tanneri*, Smith, and *A. modesta* (Stimpson), all have orbital spines, and might thus be distinguished from *A. rissoana*, forming a gradual transition to *Scyramathia*. But at all events, they conclude, the latter is distinguished from the former ' by the external widening which the basal joint of the second antennæ forms under the orbit, by the absence of spines upon that joint, and, lastly, by the transformation of certain dorsal spines of *Anamathia* into low tubercles, ordinarily truncate at the extremity.' *Scyra umbonata*, Stimpson, which A. Milne-Edwards had transferred to *Scyramathia*, is indirectly withdrawn from it by the joint authors. After alluding to the suspicion entertained by Sars that Stimpson's species might even prove to be identical with *Scyramathia carpenteri*, they say, " it is easy to determine the profound differences which separate these two crustaceans, not only in

* The authors use the expression " tigelle mobile " to designate the last three joints of the third maxillipeds, and also the movable part of the second antennæ, including stem joints and flagellum.

regard to the ornamentation of the carapace and to the form of the rostrum, but also to the relative length of the feet, thick and short in the American species, long and slender in the European."

It is unfortunate that Milne-Edwards and Bouvier seem to be unaware, not only of Alcock's work in 1899, but also of his earlier work in 1895 and 1898, so that they give no direct opinion with respect to the species which he includes in the genus *Scyramathia*. These are *S. pulchra* (Miers), of which *Anamathia livermorii*, Wood-Mason, is made a synonym; *S. rivers-andersoni*, Alcock; *S. beauchampi* (Alcock & Anderson); *S. globulifera* (Wood-Mason); *S. velutina* (Miers). It may, however, be inferred that the French authors would not accept these species, for the reception of which Alcock's definition of the genus is framed at various points differently from theirs. He speaks of the carapace as "armed either with tubercles, or with long spines much like those of *Anamathia* in their uniform size and definite arrangement," but the French definition is explained to require that some of the spines should be low tubercles, generally truncate at their extremity, as a matter of fact the low tubercles belonging to *S. occidentalis* (Faxon) and the flattened protuberances to *S. carpenteri* (Norman). That the palms of the chelipeds in the adult male are "broadened" is applicable to some of Alcock's species, but not to *S. carpenteri*, and whereas, according to Alcock, the mobile portion of the second antennæ is "freely exposed on either side of the rostrum," in the French definition, as we have seen, it is partially concealed.

The species about to be described is so closely allied to *S. carpenteri* that there can be no hesitation about placing it in the same genus.

SCYRAMATHIA HERTWIGI, Doflein.

1900. *Scyramathia Hertwigi*, Dolflein, in Chun's Aus den Tiefen des Weltmeeres, fig. on p. 497.

PLATE 6.

The rostral horns are only one-fourth of the total length of the carapace, being therefore much shorter than in *S. carpenteri*, with which the dorsal ornamentation shows much in common. Down the centre are placed at intervals a minute spine, a long, narrow tabular elevation, connected by a very faint carina with a longer and much broader table, widest in front, and lastly a rugosity on the peak of the dorsal margin. The minute spine is flanked by a pair of ridge-like tubercles, the narrow table by two broad ear-shaped tables, the broad tables by two small oval tables, a strong

curved forward-pointing tabular tooth projecting on either side of the carapace from between the large and small sub-lateral tables. The sternal plastron has deep triangular pits opposite the insertions of the legs. Of the pleon the second and third segments are much wider than the others; the third narrows distally, the sixth distally widening a little.

The second antennæ do not reach the ends of the rostral horns.

The chelipeds are very nearly as long as the first ambulatory legs, exceeding in size those of any other species attributed to this genus. The arm has three tuberculate ridges; the short wrist also has three crests; the hand is as long as the carapace rostrum included, by these proportions differing from other species, the ends of the thumb and finger fit closely together, the inner margin of each being divided into six small teeth; the basal half of the finger has a small and a large prominence, the cavity between them being filled by a tooth on the thumb, but the cavity beyond the large prominence leaving a gap. In the ambulatory feet the arm is longer than the hand, and the finger is more than half as long as the hand, with a little smooth nail, but otherwise thickly coated with spines: the rest of the limb, though smoother in appearance, is closely invested with the tuberculiform apically pointed cutaneous vesicles described by Sars, which also occur on the pleon, the mouth organs, and various parts of the body. The presence of these remarkable objects is expressly noted for *S. carpenteri* and for *S. occidentalis*, and is perhaps intended by the "short felty pubescence" which Miers describes as investing *Pugettia velutina*. It is not specified by Alcock either for that species or for the others which he refers to *Scyramathia*.

Length of carapace, 55 mm., breadth, 33 mm., length of rostrum, 14 mm.; first ambulatory leg more than twice as long as the carapace.

Habitat. A single specimen, male, taken 28 miles off Lion's Head, from a depth of 140 fathoms.

The discussion of the genus, and the description of the present species with the figure of it were completed before I had had an opportunity of consulting Professor Chun's volume, but on seeing there Doflein's figure of *S. hertwigi*, though it is unaccompanied by any description, I could not resist the conviction that it represented the very species I had been studying.

## Cyclometopa.

### Fam. : Portunidae.

1899. *Portunidae*, Alcock, Journ. Asiat. Soc. Bengal, vol. 68, pt. 2, p. 4.

Of the three genera here noticed, *Charybdis* and *Lupa* are assigned by Alcock to a sub-family Lupinae, and *Ovalipes* to a sub-family Portuninae.

GEN. : CHARYBDIS, de Haan.

1833. *Charybdis*, de Haan, Crustacea Japonica, decas prima, p. 10.
1834. *Thalamita* (part), H. Milne-Edwards, Hist. Nat. Crustacés, vol. 1, p. 462.
1838. *Charybdis*, M'Leay, Illustrations Zool. South Africa (Smith), Invertebrates, p. 61.
1843. *Charybdis*, Krauss, Die Südafrik. Crustaceen, p. 24.
1852. *Charybdis*, Dana, U.S. Expl. Exp., vol. 13, p. 285.
1860. *Goniosoma* (preocc.), A. Milne-Edwards, Ann. Sci. Nat., ser. 4, vol. 14, p. 263.
1886. *Goniosoma*, Miers, Challenger Brachyura, Reports, vol. 17, p. 189.
1893. *Charybdis*, Stebbing, History of Crustacea, p. 69.
1897. *Charybdis*, Rathbun, Proc. Biol. Soc., Washington, vol. 11, p. 161.
1899. *Charybdis* (*Goniosoma*), Alcock, Jour. Asiat. Soc. Bengal, vol. 68, pt. 2, p. 47.

The genus *Portunus* was divided by de Haan into many subgenera. To one of these he gave the preoccupied name *Oceanus*, assigning to it the single species *Cancer cruciatus* Herbat. This has been transferred to de Haan's next subgenus *Charybdis*. Fault was found with this name because of its resemblance to the earlier *Charybdea* or *Carybdea* of Péron and Lesueur. On this inadequate ground *Goniosoma* was substituted, which by the irony of fate was itself really preoccupied.

CHARYBDIS CRUCIATUS (Herbst).

1794. *Cancer cruciatus*, Herbst, Krabben und Krebse, vol. 2, pt. 5, p. 155, pl. 8, fig. 53, pl. 38, fig. 1.
1798. *Portunus crucifer*, Fabricius, Suppl. Ent. Syst., p. 364.
1833. *Portunus* (*Oceanus*) *crucifer*, de Haan, Crustacea Japonica, decas prima, p. 10.
1834. *Thalamita crucifera*, H. Milne-Edwards, Hist. Nat. Crustacés, vol. 1, p. 462.
1835. *Portunus* (*Oceanus*) *crucifer*, de Haan, Crustacea Japonica, decas secunda, p. 40.
1852. *Charybdis crucifera*, Dana, U.S. Expl. Exp., vol. 13, p. 286, pl. 17, fig. 11.

1861. *Goniosoma cruciferum*, A. Milne-Edwards, Arch. Mus. Hist. Nat., vol. 10, p. 371.
1886. *Goniosoma cruciferum*, Miers, Challenger Brachyura, Reports, vol. 17, p. 191.
1887. *Goniosoma cruciferum*, de Man, Journ. Linn. Soc. London, vol. 22, p. 79, pl. 5, fig 1.
1893. *Charybdis cruciatus*, Stebbing, History of Crustacea, p. 70.
1899. *Charybdis* (*Goniosoma*) *crucifera*, Alcock, Journ. Asiat. Soc. Bengal, vol. 68, pt. 2, p. 51.
1902. *Goniosoma cruciferum*, Lonchester, Proc. Zool. Soc. London, p. 545.

In 1783, Herbst, Krabben und Krebse, pts. 2-5, p. 153, pl. 7, fig. 52, pl. 8, fig. 53, described a species under the name *Cancer sexdentatus*. In 1794 he recognised that the carapace represented on pl. 7, fig. 52, belonged to a distinct species from that represented on pl. 8, fig. 53, and pl. 38, fig 1. Milne-Edwards, Hist. Nat. Crust., vol. 1, p. 462, 1834, introduces some confusion into the synonymy by referring to Herbst's *C. sexdentatus*, pl. 7, fig. 52, as a possible synonym of his *C. cruciatus*, without noticing pl. 8, fig. 53, which really belongs to that species. On p. 463 he gives "*Cancer sexdentatus*. Forsk" as a synonym of *Thalamita annulata* (Fabricius), thus leading to the supposition that Herbst's *C. sexdentatus* was a name preoccupied by Forskäl in 1775. But I cannot find that Forskäl ever used the name in question, though he described a species *Cancer serratus*, with "*fronte sexdentata*." *Cancer feriatus*, Linn., 1758, is based on fig. P. of pl. 6 in Rumph's Amboinsche Rariteitkamer, 1705, and Herbst identifies his *C. sexdentatus* with the same figure. But he claims, on the ground of the description given by Linnaeus, that *C. feriatus* cannot be the same species. There can, however, be little doubt that Linnaeus drew up his description in a rough and ready and inadequate fashion from the figure in Rumph's volume, and it is rather difficult to avoid the conclusion that this figure represents *C. cruciatus*. If that were admitted, the Linnean name would have to be restored But the matter is too vague for such a decision.

A dried female specimen of this beautiful species from the Cape shows the characteristic cross on the carapace, pale on a maroon ground. The carapace measured between the tips of the lowest lateral spines was 122 mm., or nearly 5 inches broad; the length from the apex of a submedian tooth to the hind margin is 80 mm., or 3 inches and a fifth. The fifth segment of the pleon is 55 mm. across, the triangular seventh segment is 17 mm. broad at the base.

Locality:—Port Alfred.

## Gen. : Lupa, Leach.

1813. *Lupa*, Leach, Edinburgh Encyclopædia, vol. 7, p. 390, Art. Crustaceology.
1825. *Lupa*, Deamarest, Consid. gén. Crustacés, p. 97.
1833. *Neptunus*, de Haan, Crustacea Japonica, decas 1, p. 7.
1834. *Lupea*, Milne-Edwards, Hist. Nat. Crust., vol. 1, p. 445.
Date? *Lupa*, Milne-Edwards, Règne Animal Cuvier, Ed. Fortin and Masson, Crustacés, p. 46.
1886. *Neptunus*, Miers, Challenger Brachyura, Reports, vol. 17, p. 172.
1897. *Portunus*, Rathbun, Proc. Biol. Soc. Washington, vol. 11, p. 155.
1900. *Portunus*, Rathbun. The American Naturalist, vol. 34, p. 140.

*Neptunus*, de Haan, is a subgenus of *Portunus*, Fabricius. *Neptunus*, Miers, is a subgenus of *Neptunus*, de Haan. *Portunus*, Rathbun, is a subgenus of *Portunus*, Latreille. Miss Rathbun points out that those who do not accept what she supposes to be Latreille's restriction of *Portunus*, Fabricius, must use *Lupa* in place of de Haan's *Neptunus*, the latter being clearly a synonym of the former. In the valuable key which Miss Rathbun supplies in 1900 to the families, genera, and species of the Cyclometopa, the character shown for distinguishing *Callinectes*, Stimpson, from the genus *Lupa* of Leach is that in the former the pleon of the male is T-shaped, but in the latter triangular.

### Lupa sanguinolenta, Herbst.

1783. *Cancer sanguinolentus*, Herbst, vol. 1, pts. 2-5, p. 161, pl. 8, figs. 56, 57.
1798. *Portunus sanguinolentus*, Fabricius, Supplementum Ent. Syst., p. 367.
1833. *Portunus* (*Neptunus*) *sanguinolentus*, de Haan, Crust. Japonica, decas 1, p. 8.
1834. *Lupea sanguinolenta*, Milne-Edwards, Hist. Nat. Crust., vol. 1, p. 451.
Date? *Lupa sanguinolenta*, Milne-Edwards, Règne Animal Cuvier, pl. 10, fig. 1, 1 a-c.
1861. *Neptunus sanguinolentus*, A. Milne-Edwards, Arch. Mus. Hist. Nat., vol. 10, p. 319.
1886. *Neptunus* (*Neptunus*) *sanguinolentus*, Miers, Challenger Brachyura, Reports, vol. 17, p. 174.
1899. *Neptunus sanguinolentus*, Alcock, Journ. Asiat. Soc. Bengal, vol. 68, pt. 2, p. 32.

As Miers observes, the three large brightly-coloured, equidistant and irregularly oval spots on the hinder part of the carapace

are very constant and characteristic of this species. There is also to be noticed a cherry red spot on the hand of the chelipeds, close to the base of the movable finger. This is shown in Herbst's figure, and in the South African specimen (preserved in formalin) this spot still retains its colour, while the three on the carapace have so faded as to require close inspection before they can be discerned. The penultimate segment of the pleon is not very broad, and widens a little from the base before narrowing to its distal extremity, so that the shape of the pleon makes some approach to that of *Callinectes*.

Locality:—Two-and-a-half miles off Cape St. Blaize.

## GEN.: OVALIPES, Rathbun.

1825. *Platyonichus* (preocc.) Latreille, Encycl. Méth Entom., vol. 10, p. 151.
1833. *Anisopus* (preocc.) de Haan, Crustacea Japonica, decas 1, p. 12.
1834. *Platyonichus*, Milne-Edwards, Hist. Nat. Crust., vol. 1, p. 435.
1838. *Xaiva*, M'Leay, Illustrations Zool. South Africa (Smith), Invertebrates, p. 62.
1843. *Anisopus*, Krauss, Die südafrik. Crustaceen, p. 27.
1886. *Platyonychus*, Miers, Challenger Brachyura, Reports, vol. 17, p. 201.
1897. *Xaiva*, Rathbun, Proc. Biol. Soc. Washington, vol. 11, p. 158.
1898. *Ovalipes*, Rathbun, Proc. U.S. Mus., vol. 21, p. 597.

*Platyonichus*, Latreille, 1818, as explained by Bell and Miss M. J. Rathbun, is a synonym of *Portumnus*, Leach, 1813, and is distinct from *Platyonichus*, Latreille, 1825, which must, therefore, lapse as preoccupied. The same fate befalls *Anisopus*, de Haan, the name having been already used in 1803. M'Leay retains de Haan's *Anisopus*, and beside it establishes a new subgenus *Xaiva*, not easily distinguishable from it, so that the latter name seemed available for the species previously known as *Platyonichus ocellatus* (Herbst) and its allies. These allies, in the Challenger Brachyura by Miers, are named "*Platyonychus bipustulatus*, Milne-Edwards, and *P. iridescens*, n. sp." In 1898 Miss Rathbun withdrew the suggestion that *Xavia* could be used as their generic name, and writes:—"It has since been brought to my attention that the type of *Xaiva*, *X. pulchella*, MacLeay, is more nearly related to *Portumnus* than it is to the species *ocellatus* and *bipustulatus*." For these last, therefore, I am obliged to propose a new name. *Ovalipes* differs from *Portumnus* and *Xaiva* in having the

last joint of the fifth pair of feet broadly oval, rounded at the extremity, instead of lanceolate and acute; the basal joint of the antennulæ advanced and visible in a dorsal view between the frontal teeth; the chelipeds elongate; the abdomen of the male oblong instead of narrow triangular.

### Ovalipes trimaculatus (de Haan).

1833. *Anisopus trimaculata*, de Haan, Crust. Japonica, decas 1, p. 13

1834. *Platyonichus bipustulatus*, Milne-Edwards, Hist. Nat. Crust., vol. 1, p. 437, pl. 17, fig. 7-10.

1838. *Anisopus trimaculatus*, M'Leay, Illustrations Zool. South Africa, p. 62.

1843. *Anisopus trimaculatus*, Krauss, die südafrik. Crustaceen, p. 27.

The *Anisopus* of de Haan was instituted as a subgenus of *Corystes*, and to it he assigned in 1833 his own species *punctata* and *trimaculata*, with the addition of *ocellata*, Herbst, doubtfully. To the name *trimaculata* n sp. he subjoined "(Seba T. xviii, fig. 9). Dr. Horstok a littore Promontorii Bonae Spei." That the specimen forwarded to me from the Cape belongs to de Haan's species *trimaculata* is beyond question, but the proper name for it may be debated. In 1834 Milne-Edwards described his *Platyonichus bipustulatus*, from the Indian Ocean, and the figure of this in his (undated) Atlas shows it to be identical with de Haan's *trimaculata*. In 1835 de Haan, decas 2, p 44 (pl. 2, fig. 1, ♂) describes *Corystes* (*Anisopus*) *punctata*, n. sp., and adds a note that *Platyonichus bipustulatus*, Milne-Edwards, appears to agree with the other species of this subgenus, which Horstok had procured at the Cape, and which was distinguished from C. punctata by shorter frontal and blunter lateral teeth, by having the thorax marked behind with two blood-red spots, the hands reddening on the inner side, the thorax and chelae yellow scarcely rubro-punctate or granulate. That he speaks of only two spots on the carapace of his trimaculate species is due to the fact that the arcuate middle spot is common both to this and *punctata*. In his index, p. 233, he mentions *punctata* alone, not naming either *trimaculata* or *bipustulatus*. Miers in 1876 and 1886 gives as synonyms of *P. bypustulatus*, *Anisopus punctatus*, de Haan, *Platyonychus purpureus*, *Dana*, and *Portunus catharus*, White. Haswell, in his Catalogue of Australian Malacostraca, 1882, does the same, except that he does not give the reference to White. It may be questioned whether the distinctions drawn by de Haan, depending chiefly on colour markings, are of specific value. It may also be questioned whether the character implied in the specific name, apart from

the reference to Seba, would give his specific name priority over that used by Milne-Edwards. The description by the latter author does not suffice to distinguish between the two forms recorded by de Haan. Milne-Edwards says nothing about the colour, and his coloured figure was probably not published till some years later. On the other hand, Seba's pl. 18, f. 9, shows three frontal teeth instead of four, is devoid of the three spots, which are not alluded to in the description, vol. 3, p. 44, "Color ab omni parte idem dilute flavus, splendens." But if *bipustulatus* is identified with *punctatus*, the priority cannot reasonably be refused to the latter name, since in 1833 it was assigned to a well-defined genus, quite as good for its identification as the specific description given by Milne-Edwards in the following year. In the generic definition de Haan calls attention to the peculiar structure of the seventh joint in the second pair of trunk legs. This finger in the adult male is falciform, dilated, and on the hind margin deeply grooved. The fissuring begins a little way from the base, and then the edges spread out, so as to give a somewhat flattened appearance to the back of the finger viewed from above. In the specific account he mentions that the femora of these same feet have a transverse membranaceous crest on the superior apex, which Miers also notices, saying, "above the articulation the margin of the thigh is raised, and forms a crest." All that I can perceive is a transverse ridge on the distal margin of the fourth joint, which is commonly called the arm, not the thigh. Krauss, who remarks the three spots on the carapace, says that *trimaculatus* is scarcely distinct from *punctatus*, though he upholds its name and reduces *bipustulatus* to a synonym. He says it is very common in Table Bay, and prefers sandy, sheltered wastes, suitable to its thin, brittle shell, and in harmony with its colouring, which in the ground work is yellow, though sprinkled with blood-red dots, in addition to the half-moon shaped median and the two postero-lateral spots.

Locality:—False Bay.

## CATOMETOPA.

1900. *Catometopa,* Alcock, Journ. Asiat. Soc. Bengal, vol. 69, pt. 2, p. 281.

Alcock says, "The *Catometopa* may be divided into 9 families. One of these, the *Gonoplacidae*, so closely approaches the Cyclometope family *Xanthidae* that such Xanthoid forms as *Geryon* and *Camptoplax* have by some authors been included in it, while, on the other hand, some of its constituent genera, such as *Gonoplax* and *Carcinoplax*, have been ranged among the Cyclometopes."

## Fam. : Goneplacidae.

1900. *Gonoplacidae,* Alcock, Journ. Asiat, Soc. Bengal, vol. 69, pt, 2, pp. 283, 297.

The following definition is given by Alcock:—" Marine Catometopes closely resembling Cyclometopes. The palp of the external maxillipeds articulates at or near the antero-internal angle of the merus [fourth joint], never at the antero-external angle or at the middle of the anterior border; the exognath of the external maxillipeds is of normal size and is not concealed. The inter-antennular septum is a thin plate. The division of the orbit into two fossae is not accented."

## Gen. : Goneplax, Leach.

1813-1814. *Goneplax,* Leach, Edinb. Encyl., vol. 7, p. 430. Art. Crustaceology.
1815. *Goneplax,* Leach, Trans. Linn. Soc. London, vol. 11, p. 323.
1816. *Gonoplax,* Leach, Encycl. Brit., p. 413, Art. Annulosa.
1837. *Gonoplax,* Milne-Edwards, Hist. Nat. Crust. vol. 2, p. 60.
1853. *Gonoplax,* Bell, British Stalk-eyed Crustacea, p. 129.
1886. *Gonoplax,* Miers, Challenger Brachyura, Reports, vol. 17, p. 245.
1873. *Gonoplax,* Stebbing, History of Crustacea, p. 91.
1900. *Gonoplax,* Alcock, Journ. Asiat. Soc. Bengal, vol. 69, pt. 2, p. 316.

Several other references might be given, but they can be easily traced The name first appears in the form *Goneplat* at page 393 of Leach's Crustaceology, but he then gives *Ocypode angulata* as the sixth species of *Ocypode,* though appending the following paragraph:—" Cancer angulatus of Linné, Fabricius, and Pennant; *Ocypode bisponosa* of Lamarck; *Goneplat bisponosa,* Leach, MSS. *Vide Goneplat* in Index."

I cannot regard this as an institution of the genus *Goneplat,* while its only species is retained under *Ocypode.* In the Index the name given is not *Goneplat,* but *Goneplax,* with a reference to page 432, although it is on page 430 that *Goneplax* is in fact defined. The reference to Linné is also misleading, since *Cancer angulatus* is a species dating from Pennant in 1777, and is subsequently mentioned, not by Linnæus, but in Gmelin's edition of the Systema Naturae.

### Goneplax angulata (Pennant).

1777. *Cancer angulatus,* Pennant, British Zoology, vol. 4, p. 7, pl. 5, fig. 10.

1782. *Cancer angulatus*, Herbst, Krabben und Krebse, vol. 1, p. 85, pl. 1, fig. 13.
1788. *Cancer angulatus*, Gmelin's Syst. Nat., vol. 1, p. 2971.
1793. *Cancer angulatus*, Fabricius, Ent. Syst., vol. 2, p. 449.
1802. *Ocypoda angulata*, Bosc, Hist. Nat. Crust., vol. 1, p. 198.
1813. *Ocypode angulata*, Leach, Edinb. Encycl., vol. 7, p 393.
1813-14. *Goneplax angulata*, Leach, Edinb. Encycl., vol. 7, p. 430.
1815. *Goneplax bispinosa*, Leach, Trans. Linn. Soc. London, vol. 11, p. 323.
1816. *Gonoplax bisponosa*, Leach Encycl. Brit., p. 413, Art. Annulosa.
1817. *Gonoplax bisponosa*, Leach, Malacostraca Podophthalmata Britanniae, text to pl. 13
1829. *Gonoplax angulatus*, Latreille, Règne Animal, vol. 4, p. 43.
1837. *Gonoplax angulata*, Milne-Edwards, Hist. Nat. Crust., vol. 2, p. 61.
1853. *Gonoplax angulata*, Bell, Brit. Stalk-eyed Crust., p. 131, fig. in text.
1893. *Gonoplax rhomboides*, Stebbing, History of Crustacea, p. 92.

The South African specimen completely agrees with Bell's description of this well-known species. It has the two pairs of lateral spines of the carapace well developed and very acute; the arm or fourth joint of the cheliped has the small spine near the middle of its upper side, and a similar spine on the inner margin of the fifth joint; the chelipeds are nearly alike, but that on the right side shows a cavity between the fingers in their proximal half, while that on the left side has the fingers close together in their whole length. The colouring, as in English specimens, is more reddened across the upper half of the carapace, and paler, yellowish on the lower half. Latreille and Milne-Edwards were disposed to unite this species with the earlier *Cancer rhomboides*, Linn., which is distinguished from it by having no lower lateral spine on the carapace, or at most, a little tubercle in its place. It must be admitted that the distinction, though marked, is not by itself highly important. Yet there is some convenience in retaining both specific names, as is done by Milne-Edwards, Carus, and others.

Locality:—Trawled 11 miles off Cape St. Blaize.

## Oxystomata.

1896. *Oxystoma* or *Leucosoidae*, Alcock, Journ. Asiat, Soc. Bengal, vol 65, pt. 2, p. 135.
1900. *Oxystomata*, M. J. Rathbun, The American Naturalist, vol. 34, p. 515.

An account of this tribe as now including the Raninidae, with

the principal references to de Haan, Miers, Ortmann, etc., will be found in Alcock's work above cited.

### FAM.: LEUCOSIIDAE.

For an account of this family, and several sub-divisions of it or "alliances," the same work (p. 164) may be consulted.

### GEN.: PHILYRA, Leach.

1817. *Philyra*, Leach, Zool. Miscell., vol. 3, p. 18.
1837. *Philyra*, Milne-Edwards, Hist. Nat. Crust., vol. 2, p. 131.
1855. *Philyra*, Bell, Trans. Linn. Soc. London, vol. 21, p. 299.
1877. *Philyra*, Targioni Tozzetti, Crost. Brachyuri e Anomouri, Magenta, p. 196.
1886. *Philyra*, Miers, Challenger Brachyura, Reports, vol. 17, p. 320.
1892. *Philyra*, Ortmann, Zool. Jahrb., vol. 6, p. 582.
1896. *Philyra*, Alcock, Journ. Asiat. Soc. Bengal, vol. 65, pt. 2, p. 237.
1900. *Philyra*, M. J. Rathbun, The American Naturalist, vol. 34, p. 517.

Alcock observes that *Philyra* can be at once distinguished from *Leucosia* by the absence of a thoracic sinus, and under *Leucosia* explains that the lateral epibranchial angles of the carapace form on either side a distinct lobe, which is bent downwards towards the base of the chellipeds to form the eave of a deep sinuous depression in the side wall of the carapace, known as the thoracic sinus. Bell points out that the extraordinary dilatation of the exopod in the third maxillipeds, which had been regarded as the essential characteristic of *Philyra*, varies greatly in degree in the several species.

### PHILYRA PUNCTATA, Bell.

1855. *Philyra punctata*, Bell, Trans. Linn. Soc. London, vol. 21, p. 291, pl. 33, fig. 2.

In agreement with Bell's description, the carapace is nearly orbicular, smooth, punctate in every part. Except for a small interval in front, the carapace is entirely surrounded by a beaded line, the little beads or projections showing in most part of the circumference considerable inequality. Similar ornaments fringe the fourth joint of the third maxillipeds and the hind margin or a transverse ridge of the first and second pleon-segments. The third maxillipeds in this species have the fourth joint very much

shorter than the third, the exopod moderately expanded. In the chelipeds the finger and thumb have three or four teeth at the distal part of each inner margin, not large, but more decidedly developed than any on the earlier part of the margins. In the male the third, fourth, and fifth segments of the pleon are coalesced, in the female, these, together with the sixth.

Length of carapace in the male specimen, 11.25 mm. by a breadth of 10 mm.

Locality:—Mossel Bay.

Bell's specimen, half an inch in length of carapace, was dredged in Simon's Bay, between four and seven fathoms, on sand.

## BRACHYURA ANOMALA.

1839. *Dromiacea* de Haan, Crustacea Japonica, decas quarta, p. 102.

1880. *Dromiaceae,* Boas, Studier over Decapodernes Slaegtskabforhold, p. 138.

1893. *Brachyura anomala* (part), Stebbing, History of Crustacea, p. 133.

1899. *Dromiaceae,* A. Milne-Edwards and Bouvier, Crust. Dé cap. de l'Hirondelle et de la Princesse Alice, Monaco, fasc. 13, p. 8.

1899. *Brachyura anomala,* Alcock, Deep-sea Brachyura R.I.M.S.S. Investigator, p. 6.

1900. *Dromiaceae,* A. Milne-Edwards and Bouvier, Crust. Dée. du Travailleur et du Talisman, p. 5.

1901. *Dromides* or *Dromiacea,* Alcock, Catalogue of the Indian Decapod Crustacea, fasc. 1, p. 28.

The French authors above cited divide the Brachyura into Dromiacae or Brachyures primitifs and Brachyura genuina. The Dromiacea or Brachyura anomala comprise three legions or three families, Dromiidæ, Homolidæ, and Dynomenidæ, in accordance with Ortmann's arrangement of the Dromiidea in 1892. The authors who have taken the lead in re-establishing this classification have fully recognized the claim of de Haan to its origination. He included in his Dromiacea the four genera *Dynomene, Homola, Dromia, Latreillia,* remarking that "the Dromiacea, with exclusion of Lithodidæ, seem to be far removed from the Anomoura, and especially from the Raninoidea and Paguridea." So circumscribed, he concludes that they ought not to be separated from the Brachyura. Alcock, whose classification is at once the most recent and the most fully and clearly explained, divides the Brachyura anomala into two tribes, the Dromiidea and Homolidea, the former including the three

families Homoldromiidæ, Dromiidæ, and Dynomenidæ, the latter embracing the Homolidæ and Latreilliidæ.

## Fam.: Dromiidae.

1899. *Dromiidae,* Alcock, Journ. Asiat. Soc. Bengal, vol. 68, pt. 2, p. 135.
1901. *Dromiidae,* Alcock, Catal. Indian Decapod Crustacea Brachyura primigenia, p. 37.

The family, as recently restricted by Alcock, contains the genera *Dromia, Eudromia, Sphaerodromia, Conchoecetes, Hypoconcha, Cryptodromia, Petalomera, Pseudodromia,* and *Lasiodromia. Dromidia,* Stimpson, including *Dromidiopsis,* Borradaile, is regarded as a sub-genus of *Dromia.* *Lasiodromia* is a new name not unreasonably substituted for *Homalodromia,* Miers, which is distinct from the earlier *Homolodromia,* A. Milne-Edwards, in a different family; but Alcock remains uncertain whether *Lasiodromia* should be separated from Stimpson's *Pseudodromia.* He is also doubtful whether *Ascidiophilus,* Richters, should be allotted to this family.

## Gen.: Conchoecetes, Stimpson.

1858. *Conchoecetes,* Stimpson, Proc. Acad. Phinlad., p. 226 (64).
1887. *Conchoecetes,* A. O. Walker, Journ. Linn. Soc. London, vol. 20, pp. 108, 111.
*Conchoecetes,* Henderson, Challenger Anomura, Reports, vol. 27, p. 17.
1893. *Conchoecetes,* Stebbing, History of Crustacea, p. 135.
1899. *Conchoecetes,* Alcock, Journ. Asiat. Soc. Bengal, vol. 68, p. 150.
1901. *Conchoecetes,* Alcock, Catal. Indian Decap. Crust., Brachyura primigenia, p. 40.

In this genus the carapace is depressed, subpentagonal; the fifth pair of legs, which are turned forwards along the sides of the carapace, are short and slender, not subchelate, with the finger minute; the preceding pair are not elongate, but robust, with a strong hooked finger, folding round the edge of the mollusc-valve, its grip upon which is aided by the obtuse process of the preceding joint.

### Conchoecetes artificiosus (Fabricius).

1798. *Dromia artificiosa,* Fabricius, Supplementum Ent. Syst., p. 360.

1803. *Cancer artificiosa*, Herbst, Krabben und Krebse, vol. 3, pt. 3, p. 54, pl. 58, fig. 7.
1837. *Dromia artificiosa*, Milne-Edwards, Hist. Nat. Crust., vol. 2, p. 176, foot-note to account of *D. fallax*, Lamarck.
1858. *Conchoecetes artificiosus*, Stimpson, Proc. Acad. Philad., p. 240 (78).
1882. *Dromia conchifera*, Haswell, Catal, Austral. Crust., p. 141, pl. 3. fig. 4. (and Proc. Linn. Soc. N.S. Wales, vol. 6, p. 757).
1887. *Conchoecetes conchifera*, A. O. Walker, Journ. Linn. Soc. London, vol. 20, pp. 108, 111.
1899. *Conchoecetes artificiosus*, Alcock, Journ. Asiat. Soc. Bengal, vol. 68, p. 151.
1901. *Conchoecetes artificiosus*, Alcock, Catal. Indian Decap. Crust., Brachyura primgenia, p. 41, pl. 3, fig. 16.

The short close pubescence which covers this species is said by Haswell to be green. In formalin it is brown, with perhaps a greenish shade in it. I do not find the dimensions given by any author except Haswell, who reports it from Port Denison and Port Molle, and gives length $\frac{21}{32}$ in.; breadth, $\frac{5}{8}$ in. The specimen from South Africa has the carapace in the medium line 21.25 mm. long, and its greatest breadth 22.25 mm., the breadth, therefore, being a little greater than the length, instead of the reverse as in the Australian specimen. But it must be remembered that the median line is measured from the central tooth of the front, which is smaller and less advanced than its two companions. A line from either of these to the hind margin gives the carapace of the African specimen a length of 22-50. The dorsal length in the median line, including the three protruded segments of the pleon, is 30 m m.

In forwarding the specimen from Cape Town, Dr. Gilchrist informed me that the animal had been tied into its valve when procured, in order to show how the shell is held, otherwise these creatures, when brought on deck, speedily leave their covert. The fourth pair of legs are, in fact, still grasping the shell valve in a defiant manner, though they appear to have shaken off the rest of the animal as a useless incumbrance, and by this detachment facility of examination was considerably increased.

Locality:—Amatikulu River N.W., distant 7½ miles (coast of Zululand), from 26 fathoms.

## Fam.: Homolidae.

1888. *Homlidae*, Henderson, Challenger Anomura, Reports, vol. 27, p. 18.
1892. *Homolidae*, Ortmann, Zool. Jahrb., vol. 6, p. 540.

1893. *Homolidae*, Stebbing, History of Crustacea, p. 137.
1899. *Homolinae*, M.-Edw. and Bouvier, Crust. Hirondelle et Princesse Alice, pp. 9, 10.
1899. *Homolidae*, Alcock, Deep-sea Brachyura Investigator, p. 6.
1899. *Homolidae* (restricted), Alcock, Journ. Asiat. Soc. Bengal, vol. 68, pt. 2, p. 154.
1900. *Homolinae*, M.-Edwards and Bouvier, Crust. Travailleur et Talisman, p. 10.
1901. *Homolidae* (restricted), Alcock, Catal. Indian Decapod Crustacea, p. 59.

In 1899 the French authors recognised in this family seven genera, *Paromola*, *Paromolopsis*, and *Hypsophrys*, instituted by Wood-Mason; *Homologenus* and *Latreillopsis*, by Henderson; *Homola*, Leach; and *Latreillia*, Roux. They remark that the species of *Paromola* are the primitive forms of the group, and that *Latreillia* is linked to it by the intravention of *Latreillopsis*. Alcock distinguishes three sub-genera of *Homola*, namely, *Homola*, *Homolax*, and *Paromola*. This writer also, in the Journ. Asiat. Soc. Bengal vol. 68, p. 155, 1899, separates *Latreillopsis* and *Latreillia* from the Homolidæ, placing them in a new family Latreillidæ, in this respect following the lead of S. I. Smith, who in 1883 distinguished the Latreillidea from the Homolidea, although with Alcock Homolidea is an over-group embracing the two families, the Latreillidæ (or rather Latreilliidæ) being distinguished by very elongate eye-stalks, by having eight pairs of gill plumes, and no epipods on the trunk legs, while in the Homolidæ the eye-stalks are not so elongate, the gill plumes are in thirteen or fourteen pairs, and there are epipods on the chelipeds and often on the two following pairs of legs.

## Gen.: Homola, Leach.

1815. *Homola*, Leach, Trans. Linn. Soc. London, vol. 11., p. 324.
1863. *Homola*, Heller, Crust. des südlichen Europa, p. 148.
1896. *Homola*, Bouvier, Bulletin Soc. Philomathique de Paris, vol. 8, p. 70 (37), etc.
1901. *Homola*, Alcock, Indian Decapod Crustacea, fasc. 1. p. 60.

The very numerous references to this genus can be traced from those here given for the family and the typical species. For *Homola* as a subgenus, Alcock names *H. barbata* as the type, for *Homolax* *H. megalops*, Alcock, and for *Paromola*, Wood-Mason, *H. cuvieri* (Risso). For the sub genus *Homola* he gives the following character:—

Carapace quadrate, its broadest part being in front, across the middle of the gastric region: the *lineae anomuricae* keep close to the lateral borders, and are rather inconspicuous. Rostrum a

bifid tooth, with a small spine or tooth on either side of its base. The last pair of legs reach to the end [of the carpus, *i.e.*, fifth joint]* of the preceding pair."

The species allotted to this subgenus are H. *barbata* (Fabricius), *H. vigil*, A. Milne-Edwards; *H. orientalis*, Henderson; and *H. andamanica*, Alcock; but the last is regarded as possibly a synonym of Henderson's species, and probably only a variety of *H. barbata*.

### Homola barbata (Fabricius).

1793. *Cancer barbatus*, Fabricius, Ent. Syst., vol. 2, p. 460, No. 76.
1796. *Cancer barbatus*, Herbst, Krabben und Krebse, vol. 2, pt. 6, p. 166, pl. 42, fig. 3.
1815. *Homola spinifrons*, Leach, Trans. Linn. Soc. London, vol. 11, p. 324.
1837. *Homola spinifrons*, Milne-Edwards, Hist. Nat. Crust., vol. 2, p. 183, pl. 22, fig. 1-4, and in the undated Règne Animal (Ed. Fortin, Masson et Cie), pl. 39, fig. 2.
1847. *Homola barbata*, White, Crustacea in British Museum, p. 55.
1863. *Homola spinifrons*, Heller, Crust. des südlichen Europa, p. 149, pl. 4, figs. 12, 13.
1884. *Homola barbata*, S. I. Smith, Fishery Report for 1882, p. 351 (7).
1888. *Homola barbata*, Henderson, Challenger Anomura, Reports, vol. 27, p. 18.
1899. *Homola barbata*, Alcock, Journ. Asiatic Soc. Bengal, vol. 68, pt. 2, p. 156.
1900. *Homola barbata*, Milne-Edwards and Bouvier, Crust. Décap. Travailleur et Talisman, p. 10.
1901. *Homola barbata*, Alcock, Indian Decapod Crustacea, fasc. 1, p. 79.

Many more references are given in Alcock's last-mentioned work, including, doubtfully, *H. spinipes*, Guilding, Trans. Linn. Soc., vol. 14, p. 334, 1825. In 1818 Lamarck assigned the species as named by Leach to *Dorippe*. White, probably following Desmarest, suggests that it may be a representative of Rafinesque's genus *Thelxiope*. The specific name given by Fabricius was by many authors ignored in favour of Leach's *spinifrons*. H. Milne-Edwards, Heller, Henderson, A. Milne-Edwards and Bouvier, agree in assigning the name *barbatus* to Herbst, though Herbst himself gives the reference for it to Fabricius. White refers both to Fabricius and Herbst, but inverts the order. Alcock puts the whole matter rightly, except

* A comparison of this quotation from the Catalogue of 1901 with the corresponding passage in the Journ. Asiat. Soc., 1899, shows that the words in brackets were accidentally omitted.

that the reference to Fabricius is unfortunately printed as p. 450 instead of 460. Fabricius himself has a species *Cancer spinifrons,* which was instituted by Herbst in 1785, Krabben und Krabben, vol. 1, pt. 6, p. 185, pl. 11, fig. 65. This species has nothing whatever to do with Leach's *Homola spinifrons,* but for those who may wish to verify this by the original authorities it should be mentioned that Fabricius twice gives a misleading reference to Herbst. In the Ent. Syst., vol. 2, p. 455, he refers to "Cancer spinifrons, Herbst. Cancr. tab. 9. fig 58.," and in the Supplementum he repeats this reference after one to his own work, as though he himself were the author of the species.

The South African specimen has the carapace ornamented as figured by Milne-Edwards and described by Heller, and likewise in agreement with the account given by Alcock of his *Homola andamanica.* There are 13 spines between the short, slightly depressed bifid rostrum and the cervical groove, and down each side there is a row, beginning with a large tooth-like spine, followed by a smaller one, and then by diminishing denticles to the number of a dozen. The epistome has a central upturned spine. The fourth joint of the third maxilliped being abruptly narrowed in the distal half, looks as if a piece had been cut out of its outer margin. The fourth joint in the four pairs of ambulatory legs is setose or spinulose on the inner margin, but seems devoid of the tooth spines which are characteristic of *H. andamanica.*

Length, 29 mm.

Locality:—False Bay, from 32 fathoms.

## Fam.: Latreilliidae.

1899. *Latreillidae,* Alcock, Journ. Asiat. Soc. Bengal, vol. 68, pt. 2, pp. 130, 165.

1901. *Latreillidae,* Alcock, Catal. Indian Decapod Crustacea, p. 70.

For the distinction of this family from the Homolidæ see page 21.

## Gen.: Latreillia, Roux.

1828. *Latreillia,* Roux, Crustacés de la Méditerranée, livraison 5, pl. 22.

1834. *Latreillia,* H. Milne-Edwards, Hist. Nat. Crust., vol. 1, p. 277.

1839. *Latreillia,* de Haan, Crustacea Japonica, decas quarta, p. 105.

1863. *Latreillia,* Heller, Crust. südl. Europa, p. 146.

1888. *Latreillia,* Henderson, Challenger Anomura, Reports, vol. 27, p. 23.
1893. *Latreillia,* Stebbing, History of Crustacea, p. 137.
1894. *Latreillia,* A. Milne-Edwards and Bouvier, Crust. Déc. Hirondelle, fasc. 7, p. 59.
1897. *Latreillia,* Bouvier, Bull. Soc. Philom. Paris, Ser. 8, vol. 8, pp. 30, etc.
1899. *Latreillia,* M.-Edwards and Bouvier, Crust. Hirondelle et Princesse-Alice, fasc. 13, p. 13.
1899. *Latreillia,* Alcock, Journ. Asiatic Soc. Bengal, vol. 68, pt. 2, p. 167.
1901. *Latreillia,* Alcock, Indian Dec. Crust., fasc. 1, p. 70.

To this genus have been assigned five species—*L. elegans,* Roux; *L. valida,* de Haan; *L. pennifera,* Alcock; *L. phalangium,* de Haan; *L. australiensis,* Henderson. The latter two are set apart from the first three by having the fifth trunk legs of much less considerable length. The resemblances and differences in the first three are discussed under the following specific description:—

### LATREILLIA ELEGANS, Roux.

1828. *Latreillia elegans,* Roux, Crust. Médit., pl. 22.
1834. *Latreillia elegans,* Milne-Edwards, Hist. Nat. Crust., vol. 1, p. 277.
1839. *Latreillia elegans,* de Haan, Crust. Japonica, decas quarta, p. 108.
1849. *Latreillia elegans,* Lucas, Crust. Algérie, p. 3, pl. 1, fig. 1.
1863. *Latreillia elegans,* Heller, Crust. des südlichen Europa, p. 147, pl. 4, fig. 14.
1883. *Latreillia elegans,* Smith, Proc. U.S. Mus., vol. 6, No. 1, p. 23.
1884. *Latreillia elegans,* Smith, Annual Fishery Report U.S. for 1882, p. 351 (7), pl. 2, fig. 2, 2a, pl. 3, fig. 1.
1886. *Latreillia elegans,* Smith, Ann. Fishery Report for 1885, p. 33.
1894. *Latreillea elegans,* A. M.-Edwards and Bouvier, Crust. Décap. Hirondelle, Monaco, fasc. 7, p. 59, pl. 6, figs. 13-15.
1899. *Latreillea elegans,* A. M.-Edwards and Bouvier, Crust. Princesse-Alice, Monaco, fasc. 13, p. 13.
1900. *Latreillea elegans,* A. M.-Edwards and Bouvier, Crust. Décap. Travailleur et Talisman, p. 13.
1901. *Latreillia elegans,* Alcock, Indian Decapod Crustacea, p. 80 (Synonymy).

To the above should perhaps be added:—

1839. *Latreillia valida,* de Haan, Crust. Japonica, decas quarta, p. 107, pl. 30, fig. 1.

1888. *Latreillia valida,* Henderson, Challenger, Macrura, Reports, vol. 27, p. 24.

1893. *Latreillia valida,* Stebbing, History of Crustacea, p. 137, pl. 5 (from de Haan).

1899. *Latreillia pennifera,* Alcock, Journ. Asiat. Soc. Bengal, vol. 68, p. 168.

1901. *Latreillia pennifera,* Alcock, Indian Decapod Crustacea, p. 71, pl. 7, fig. 27.

It should be observed that Major Alcock himself introduces his species with the remark that it is "very closely related to *L. elegans,* Roux." The specific name which he gives to the Indian form is highly appropriate to the penultimate joint in the last pair of legs, it being, as he says, "plumed on both sides so as to exactly resemble the vane of a feather." This character is equally conspicuous in the specimen forwarded to me from the Cape, but when originally describing this form before I had seen Major Alcock's figure and description, I persuaded myself that it was identical with de Haan's *L. valida,* and that the remarkable feathering had not attracted that author's attention in a dried example or had been by some accidental circumstance removed. In point of fact, de Haan's artist does give a fringe of setules to the joint in question. But the same joint is drawn by S. I. Smith very distinctly feathered on both sides in a United States specimen of *L. elegans,* and the feathering at least for one margin is shown with equal clearness in the figures given by Lucas for a Mediterranean example of the same species. De Haan distinguishes *L. elegans* from the Japanese form by its not having a dorsal spine on the gastric region, by the greater length of the eye-stalks and frontal spines, by the fourth segment of the pleon being bispinose in the middle, and by the thinner legs. Roux only had female specimens, and de Haan does not claim to have examined any but one from Roux' own collection, so that Heller's statement that de Haan observed the male also seems to be a mistake. But de Haan's statement that the composite fourth segment of the pleon in the female of *L. elegans* is bispinose in the middle must also be mistaken. Milne-Edwards, Lucas, Heller, agree in stating that the two pairs of spines on this segment are lateral or sublateral. The lower pair seem to be minute. A distinction depending on the comparative lengths of eye-stalks and frontal spines cannot well be trusted, since they are apparently not a little variable. In a detail figure Smith represents the spines as quite unsymmetrical. Any difference in the thickness of the legs between the forms here compared seems unappreciable, so that for specific distinction nothing remains but the presence or absence of two or three insignificant-looking spines and the greater or less length of the setæ on a particular joint.

The South African specimen has the frontal spines extending along the basal joint of the eye-stalk just to the thicker terminal

joint; they have a denticle on the outer side at the base and another a little higher, and near the apex two with an inward direction. Alcock speaks of them in *L. pennifera* as occasionally bearing some tiny secondary spinules, and Heller says in regard to *L. elegans* that they have one or two little denticles below on the outer side, and generally another denticle outward at the base over the insertion of the first peduncular joint of the inner antennæ. The first antennæ, straightened out, would reach the end of the frontal spines. The chelipeds agree with Alcock's and Heller's descriptions, in having spines along the fourth joint, the following joints smooth, but the slender finger which just matches the thumb is not half as long as the carpus or fifth joint. Heller says that this finger is "only half as long as the carpus." Alcock says "the fingers are not half the length of the palm." The long second and third legs agree also with the descriptions in the two authors just mentioned, the fourth joint being distinctly spinose, the fifth sparsely so, the sixth chiefly at the slightly dilated apical portion, and the finger on its outer margin. The fourth pair of limbs is missing. The fifth pair, though shorter than the preceding third pair, reach well beyond its fifth joint; they have the fourth and fifth joints spinose, the sixth feathered on both margins with plumose setæ, the finger, as in Alcock's description and Smith's figure "extremely short." The pleon has a median spine on the second and on the third segment, and one at each side of the base of the composite fourth; the terminal segment ends very acutely. The pleon is enormously distended by a multitude of small eggs. Milne-Edwards and Bouvier refer to the small and numerous eggs in this species, and S. I. Smith calculated that a specimen, of which the carapace without the rostral spines was 12 mm. long, was carrying 1,650 eggs. The length mentioned by Professor Smith fairly corresponds with that of the specimen here described. Henri Milne-Edwards gives the length as about an inch, but the measurement does not convey much meaning, as it may or may not include the frontal spines and the three segments of the pleon which are visible in a dorsal view. The pleon of the male is said by Lucas and Heller to be entirely smooth. For *L. valida* de Haan says that the second segment in the male is "unispinosus." Alcock describes the pleon of the female in *L. pennifera* in agreement with that of the South African form, but does not say whether the male has the pleon free from spines or not.

Orange banding is perceptible on the limbs, eye-stalks, and frontal spines, but the carapace (in formalin) is colourless.

Locality:—Two miles N. by W. of Umbwalumi River, Natal, from 25 fathoms.

## MACRURA ANOMALA.

By the most recent arrangement these are divided into Paguridea, Galatheidea, and Hippidea. As Alcock explains in his Catalogue of Indian Deep-Sea Crustacea, p. 204, 1901, they are the Anomala of de Haan and Boas, and differ "from the *Anomura* of Milne-Edwards in the exclusion of the *Dromidae, Homolidae, Raninidae,* and *Pactolus,* and in the inclusion of the Galatheidae: from the *Anomoura* of Dana in the exclusion of the *Anomoura superiora*: from the *Anomura* of Henderson in the exclusion of the *Dromidea* and *Raninidea*, and they correspond with the *Anomoura Schizosomi* of Stimpson."* Of the five legions adopted for their classification in my History of Crustacea, 1893, the Pagurinea and Lithodinea belong to the Paguridea, the Porcellaninea and Galatheinea to the Galatheidea. This last tribe is now divided by Ortmann and by Alcock into four sections or families—Aeglaeidae, Porcellanidae, Galatheidae, and Uroptychidae. A. Milne-Edwards and Bouvier (1899) prefer to use a slightly different terminology, speaking of a family Galatheidæ, with three sub-families—Aegleinæ, Galatheinæ, Diptycinæ, the Galatheinæ comprising two tribes, the "Galatheinés and Porcellaniens."

### FAM.: PORCELLANIDAE.

Henderson, in his Report on the Challenger Anomura, gives the Porcellanidæ without definition as the single family of the Porcellanodea, which is his Section A of the Galatheidea. He gives the following definition of the section, which will apply to the single family:—

"Carapace broadly ovate, smooth, with the regions but faintly defined; the front usually trilobed, and the processes never of great length. Chelipedes broad and often flattened, the ambulatory limbs robust and of moderate length. Antennules concealed; the antennal peduncle directed backwards. Eyes always pigmented and partially concealed in orbits. External maxillipedes with the ischium [third joint] broad, and the merus [fourth joint] provided with a prominent internal lobe. Abdomen bent under the thorax; females with two (or three) pairs of slender uniramous appendages borne on the fourth, fifth, (and third) segments; males with a single genital pair on the second segment.

* Milne-Edwards, Hist. Nat. Crust., vol. 2, p. 163 uses the expression "Section des Décapodes Anomoures;" Dana, U.S. Expl. Exp., Crustacea, pp. 1429, 1430, following upon Section 1, Anomoura superiora, has Section 2, Anomoura media, Section 3, Anomoura submedia, and Section 4, Anomoura inferiora; Stimpson, in part 7 of his Prodromus, Proc. Acad. Sci. Philad., 1858, at p. 65 introduces the Schizosomi as second division of the Crustacea Anomoura.

## Gen.: Porcellana, Lamarck.

1801. *Porcellana,* Lamarck, Syst. Anim. sans vertèbres, p. 153.
1858. *Porcellana* (restricted), Stimpson, Proc. Acad. Sci. Philad., p. 228 (66).
1886. *Porcellana,* Henderson, Challenger Anomura, Reports, vol. 27, p. 109.

Henderson, who gives a long list of references, supplies the following definition:—"Carapace suborbicular or subovate, the length usually greater than the breadth. Frontal region prominent and dentate, the teeth usually well developed. Eyes of moderate size, the orbits deep. Chelipeds moderately flattened, the carpus short and usually provided with a single projecting lobe near the proximal end of the internal margin; the digits frequently contorted. Ambulatory limbs with the dactyli short and robust, terminating in a single claw."

### Porcellana dehaanii, Krauss.

1843. *Porcellana dehaanii,* Krauss, Die südafrik. Crustaceen, p. 59, pl. 4, fig. 2.
1858. *Porcellana Dehaani,* Stimpson, Proc. Acad. Sci. Philad., p. 229 (67).
1858. *Porcellana streptocheles,* Stimpson, Proc. Acad. Sci. Philad., pp. 229 (67), 243 (81).
1886. *Porcellana streptocheles,* Henderson, Challenger Anomura, Reports, vol. 27, p. 110.

Stimpson distinguishes his species from that of Krauss by its having the carapace bare, the front broader, the median tooth less prominent, and the super-antennary margin not denticulate. But according to Henderson "in the Challenger specimens short stout hairs arranged in tufts are noticeable on the gastric, cardiac, and bronchial areas." In our specimens there are two conspicuous tufts behind the front on the gastric area, but no others; the median tooth is with or without hairs, and a little more prominent than the other two frontal teeth; below a notch under the second antenna there is a sub-marginal ridge of four or five little lateral denticles, the lowest but one being slightly the largest. Henderson recognizes that *P. streptocheles* is closely allied to *P. dehaanii,* but observes that in the latter "the chelipedes are smooth and the carpi unarmed, the median frontal tooth is conical and prominent, and the antero-lateral margin of the carapace is denticulate over the insertion of the antennal peduncle." These differences, however, may in part be attributed to the state of individual specimens and in part to the observer's opinion of what was worth noting. Krauss speaks of the carpus as having the margin entire, while Stimpson speaks of it as smooth, obsoletely 2-3 dentate on

each side. On the important character of the contorted smaller chela, with its gaping fingers, both of them strongly pilose on the inner margin, they are agreed. That Stimpson speaks of the fourth joint in the walking legs as "*gracilis*" may be explained by supposing him to refer to the thickness of the joint, not to its breadth.

Locality:—False Bay. The Challenger specimens and Stimpson's were taken in Simon's Bay. Krauss describes his as very common in the sinuosities of *Eschara foliacea*, Linn., on the terraces of the Natal coast.

## Fam.: Galatheidae.

1899. *Galatheidae*, Ortmann, Bronn's Thierreich, Malacostraca, p. 1,150.
1901. *Galatheidae*, Alcock, Catal. Indian Deep-Sea Crust., Macrura, and Anomala, p. 236.

Though the family Galatheidae is not a new one, its present restriction is quite recent. Alcock distinguishes it from the companion family Uroptychidæ as follows:—

"The telson, which is not folded beneath the preceding abdominal somite, is distinctly made up of plates which suggest a tergum and a pair of appendages modified; the last thoracic sternum is narrow, but well formed; the antennal peduncle appears to be four-jointed, the second and third joints being united; the incisor edge of the mandible is entire; a foliaceous epipodite is present on the first maxillipeds, and a flagelliform epipodite is almost always present on the external maxillipeds."

In *Galathea* and *Munida* the exopod of the first maxillipeds terminates in a flagellum, and the eyes are facetted and well-pigmented, none of which characters belong to the genera *Munidopsis* and *Galacantha*.

## Gen.: Munida, Leach.

1820. *Munida*, Leach, Dict. Sci. Nat., vol. 18, p. 52.
1853. *Munida*, Bell, Brit. Stalk-eyed Crust., p. 206.
1888. *Munida*, Henderson, Challenger Anomura, Reports, vol. 27, p. 123.
1888. *Munida*, Bonnier, Bull. Sci. France-Belgique, ser. 3, vol. 1, p. 78.
1894. *Munida*, A. Milne-Edwards and Bouvier, Crust. décap. Hirondelle, fasc. 7, Monaco, p. 83.
1901. *Munida*, Alcock, Catal. Indian Deep-Sea Crust., Macrura and Anomala, p. 237.

Numerous other references can be traced from the above, and from the following account of a species. The characters used for

distinguishing this genus from *Galathea* are not of high importance. Henderson, with whom other authors are in substantial agreement, notes that the rostrum is slender and stiliform, with a well-developed supraorbital spine on either side of its base; that the carapace has the surface usually spinulose and the cardiac area as a rule distinctly circumscribed; that the chelipeds and ambulatory limbs are elongated and slender, and that one or more of the pleon segments usually has a series of spinules on the anterior margin.

### MUNIDA SANCTI-PAULI, Henderson.

1885. *Munida militaris* (?), Henderson, Ann. Nat. Hist., ser. 5, vol. 16, p. 410.
1885. *Munida Sancti-Pauli*, Henderson, Ann. Nat. Hist. ser. 5, vol. 16, p. 411.
1888. *Munida Sancti-Pauli*, Henderson, Challenger Anomura, Reports, vol. 27, p. 142, pl. 3, fig. 6.
1894. *Munida Sancti-Pauli*, A. Milne-Edwards and Bouvier, Ann. Sci. Nat., ser. 7, vol. 16, pp. 229, 256.
1894. *Munida Sancti-Pauli*, A. Milne-Edwards and Bouvier, Crust. décap. Hirondelle, fasc. 7, p. 85 (M. Bourgeti on pl. 8, figs. 11-23).
1899. *Munida Sancti-Pauli*, A. Milne-Edwards and Bouvier, Crust. Hirondelle et Princesse-Alice, fasc. 13, Monaco, p. 74.
1900. *Munida Sancti-Pauli*, A. Milne-Edwards and Bouvier, Crust. décap. Travailleur et Talisman, p. 293, pl. 6, fig. 8, pl. 29, figs. 19-21.

On the gastric area the carapace has a transverse row of from six to eight spinules parallel to the frontal margin; there are seven teeth on the lateral margin, the largest in front; the hind margin is unarmed. The second pleon segment has on its front margin eight to ten spinules; the remaining segments are glabrous. The third maxillipeds have on the fourth joint two prominent spines, the smaller of which is apical. The chelipeds are not so elongated as in *Munida rugosa*; their joints are strongly spinose; there is little cavity and sometimes none between the closed fingers; the movable one has a tolerably conspicuous spine on its outer margin near the base, and near the base of its cutting edge one or two variably conspicuous teeth or tubercles. The sternal plastron is without the numerous striated lines observable in *Munida rugosa*.

In their latest work Milne-Edwards and Bouvier say that *M. heteracantha* Ortmann (1892), *M. militaris* Henderson (1885), and *M. propinqua* Faxon (1895) belong to the same group as *M. sancti-pauli*, all with two spines on the fourth joint of the third

maxillipeds, but they recognize that in *M. heteracantha* the eyes are less dilated, and that there are some differences in the armature of *M. propinqua,* but they cannot find any distinction between *M. militaris* Henderson (1885) and his *M. sancti-pauli.* Henderson himself had already made his *M. vitiensis* a synonym and reduced his *M. curvirostris* to a variety of *M. militaris.* In *M. propinqua* there seem to be more differences of armature than those noticed by the French authors, and in *M. militaris* there are a few. But if, as those authors suggest, *M. militaris* and *M. sancti-pauli* should be regarded as one species, *M. militaris,* as the earlier name is the one that ought to stand, unless that also ought to be superseded by *M. miles* A. Milne-Edwards (1880).

Locality:—Buffalo River north 10 miles. Depth, 310 fathoms. Bottom, coral and mud. The greatest depth recorded is that of a specimen taken by the Prince of Monaco at the Azores in 758 fathoms.

## FAM.: UROPTYCHIDAE.

1892. *Chirostylidae,* Ortmann, Zool. Jahrb., vol. 6, p. 244.
1894. "*Diptycinés,*" A. Milne-Edwards and Bouvier, Ann. Sci Nat., ser. 7, vol. 16, pp. 296, 312.
1896. *Chirostylidae,* Ortmann, Zool. Jahrb., vol. 9, p. 433.
1896. *Diptycinae,* Bouvier, Bull. Soc. Entom. France, vol. 65, p. 312.
1900. *Diptycinae,* A. Milne-Edwards and Bouvier, Crust. décap. Travailleur et Talisman, p. 350.
1901. *Uroptychidae,* Alcock, Catal. Indian Deep-Sea Crust., Macrura and Anomala, p. 278.

The first name of the family was based on *Chirostylus,* a synonym of the earlier *Ptychogaster.* The second claimant was derived from the pre-occupied name *Diptychus,* for which Henderson substituted *Uroptychus,* and that seems to form a proper foundation for the name of the family, which has been detached from the Galatheidæ.

*Diptychus* and *Ptychogaster* were both instituted by A. Milne-Edwards in 1880, but the former took precedence.

The characters distinguishing this family from the Galatheidæ are given by Alcock as follows:—

"The telson, which is transversely fissured, is, along with the caudal swimmerets, folded beneath the preceding abdominal somites; the last thoracic sternum is more or less atrophied; the antennal peduncle is five-jointed, the third joint being quite distinct from the second; the incisor edge of the mandible is serrated; no epipodites on any of the maxillipeds." It will be easily understood that the folding in of the telson suggested the

name *Uroptychus,* tail-folding, and that the accession of this fold to the ordinary infolding of the pleon suggested the name *Diptychus,* double-folding.

### Gen.: Uroptychus, Henderson.

1880. *Diptychus* (pre-occ.), A. Milne-Edwards, Bull. Mus. Comp. Zoöl. Harvard, vol. 8, p. 61.
1888. *Uroptychus,* Henderson, Challenger Anomura, Reports, vol. 27, p. 173.
1888. *Diptychus,* Bonnier, Bull, Sci. France-Belgique, ser. 3, vol. 1, p. 83.
1892. *Uroptychus,* Ortmann, Zool. Jahrb., vol. 6, p. 248.
1893. *Uroptychus,* Stebbing, History of Crustacea, p. 177.
1894. *Diptychus,* A. Milne-Edwards and Bouvier, Crust. décap. Hirondelle, Monaco, fasc. 7, p. 87.
1895. *Uroptychus,* Faxon, Mem. Mus. Comp. Zoöl, Harvard, vol. 18, p. 101.
1899. *Diptychus,* A. Milne-Edwards and Bouvier, Crust. décap., Monaco, fasc. 13, p. 87.
1901. *Uroptychus,* Alcock, Catal. Indian Deep-Sea Crust., Macrura and Anomala, p. 281.

The strongly developed exopod or acicle of the second antennæ is a characteristic feature of the genus.

### Uroptychus nitidus (A. Milne-Edwards).

1888. *Diptychus nitidus,* A. Milne-Edwards, Bull. Mus. Comp. Zoöl. Harvard, vol. 8, p. 62.
1888. *Uroptychus nitidus,* Henderson, Challenger Anomura, Reports, vol. 27, p. 174, pl. 21, fig. 6.
1894. *Uroptychus nitidus,* Alcock and Anderson, Journ. Asiat. Soc. Bengal, vol. 63, pt. 2, p. 33
1894. *Diptychus nitidus,* var. *concolor,* A. Milne-Edwards and Bouvier, Ann. Sci. Nat., Zool. ser. 7, vol. 16, pp. 225, etc., figs. 16, 21.
1896. *Uroptychus nitidus,* var. *concolor,* Caullery, Campagne Caudan, fasc. 2, p. 393.
1899. *Diptychus nitidus,* var. *concolor,* A. Milne-Edwards and Bouvier, Crust. décap. Monaco, fasc. 13, p. 87, pl. 1, fig. 2.
1900. *Diptychus nitidus,* var. *concolor,* A. Milne-Edwards and Bouvier, Crust. décap. Travailleur et Talisman, p. 360, pl. 4, fig. 4, pl. 32, figs. 15-19.

Faxon, in his stalk-eyed crustacea of the Albatross (Mem. Mus. Comp. Zoöl., vol. 18, p. 101, pl. 26, fig. 1, 1a, 1895), describes a var. *occidentalis*. Milne-Edwards and Bouvier notice several variations of their var. *concolor*, the form with which the South African specimens should be identified, if a varietal name is necessary. The distinctions drawn by the French authors between the typical form and the var. *concolor* refer to the antennæ, the mandibles and the trunk legs. The variety has sharp denticles on the ventral surface of the third and fourth joints of the chelipeds, where the type is almost smooth. In the African specimens the third joint is almost smooth, the fourth and fifth joints have rows of rather sharp little tubercles; the fifth joint is almost cylindrical as in *concolor* rather than obtusely angled above as in the type. A dissected specimen has the cutting edge of the mandible divided into ten teeth, and the walking legs have ten spines on the concave margin of the finger, characters which are used to distinguish *concolor* from the typical form, which has twelve teeth to the mandibular edge and twelve spines on the finger margin. The fingers of the chelipeds are hairy at the extremity, but in this respect not so densely and beautifully ornamented as the last two joints of the third maxillipeds.

Locality:—Cape Natal N. by E. (approx.) 24 miles. Depth, 440 fathoms. Bottom, mud.

## MACRURA GENUINA.

Under the title of "Macrura Astacides," Alcock in his "Descriptive Catalogue of the Indian Deep-Sea Crustacea, Decapoda Macrura and Anomala," 1901, has recently given a synopsis of the families Nephropsidæ, Eryonidæ, Palinuridæ, Scyllaridae, Axiidæ, and Callianassidæ. As these include all the families of genuine Macrura with which we are here concerned, it will be sufficient to refer the reader to the work mentioned.

### FAM.: NEPHROPSIDAE.

#### GEN.: NEPHROPSIS, Wood-Mason.

1873. *Nephropsis*, Wood-Mason, Journ. Asiat. Soc. Bengal, vol. 42, pt. 2, p. 39, and Ann. Nat. Hist., ser. 4, vol. 12, p. 59.
1874. *Nephropsis*, A. Milne-Edwards, Ann. Sci. Nat., ser. 5, vol. 19.
1879. *Nephropsis*, Norman, Ann. Nat. Hist., ser. 5, vol. 4, p. 182.
1881. *Nephropsis*, S. I. Smith, Proc. U.S. Mus. for 1880, p. 431.
1888. *Nephropsis*, Bate, Challenger Macrura, Reports, vol. 24, p. 165.

1893. *Nephropsis*, Stebbing, History of Crustacea, p. 206.
1895. *Nephropsis*, Faxon, Mem. Mus. Comp, Zoöl. Harvard, vol. 18, p. 127.
1901. *Nephropsis*, Alcock, Indian Deep-Sea Crustacea, Macrura and Anomala, p. 157.

In this genus, which is distinguished from its nearest neighbours by having no scale to the second antennæ, Alcock discriminates five Indian species—*stewarti* Wood-Mason, *carpenteri* Wood-Mason, *atlantica* Norman, *ensirostris* Alcock, and *suhmi* Bate. Faxon describes *occidentalis* from the neighbourhood of Acapulco, Mexico, and identifies *aculeatus* Smith and *rosea* Bate with the earlier *agassizii* A. Milne-Edwards, 1880. Professor Smith described the species independently, only becoming acquainted with the account given by Milne-Edwards in time to add a note recognizing the priority of the French author.

### Nephropsis atlantica, Norman.

1882. *Nephropsis atlantica*, Norman, Proc. R. Soc. Edin., vol. 11, p. 684.
1891. *Nephropsis atlantica*, Wood-Mason, Ann. Nat. Hist., ser. 6, vol. 7, p. 197, fig. 4 in text.
1896. *Nephropsis atlantica*, Caullery, Campagne Caudan, Ann. Univ. Lyon, p. 384.
1901. *Nephropsis atlantica*, Alcock, Indian Deep-Sea Crustacea, Macrura and Anomala, p. 161.

From the other Indian species *N. atlantica* is distinguished in Major Alcock's key by combining lateral spines on the rostrum, a spine on anterior margin of side-plate in second pleon-segment, with transverse suture of outer ramus of uropods. This combination distinguishes it also from *N. occidentalis*, since that is without the lateral spine on the second segment of the pleon. *N. atlantica* is variable in the lateral spines of the rostrum, having usually two pairs, sometimes three, occasionally one and a half. In accordance with this statement by Major Alcock, out of four specimens from South Africa, one has three pairs, two have two pairs, and one has a pair and a half of these spines. Dr. Faxon describes *N. occidentalis* as having only one pair, but adds that in one young example the rostrum is armed with two spines on one side and with one on the other side. In addition, however, to other differences, a sharp median spine on the base of the telson separates *N. occidentalis* from all the other species.

A female specimen, carrying a few large eggs, has the left cheliped 56 mm. long, but that on the right only 23 mm., its last five joints being a reproduction, quite hairless, slender and white, in contrast with the adjoining orange red, strongly setose third maxillipeds, which have the inner margin of the third joint toothed or nodulose.

Locality:—Cape Natal N. by E. (approx.) 24 miles. Depth, 440 fathoms. Bottom, mud.

### Fam.: Eryonidae.

1837. "*Tribu des Eryons,*" Milne-Edwards, Hist. Nat. Crust., vol. 2, pp. 270, 278.
1841. *Eryonidae*, de Haan, Crust. Japonica, p. XIX., and Decas quinta, p. 149.
1852. *Eryonidae,* Dana, U.S. Expl. Exp., Crustacea, pt. 1, p. 515.
1880. *Eryontidae*, S. I. Smith, Proc. U.S. Mus. for 1879, p. 345.
1880. *Eryonidae*, Boas, Vidensk-Selsk. Skr., ser. 6, vol. 1, pp. 94, 184.
1884. *Eryonidae*, Bate, Geological Magazine, Decade 3, vol. 1, p. 307.
1888. *Eryonidae,* Bate, Challenger Macrura, Reports, vol. 24, p. 100.
1893. *Eryontidae*, Stebbing, History of Crustacea, p. 199.
1895. *Eryontidae,* Faxon, Mem. Mus. Comp. Zoöl. Harvard, vol. 18, p. 108.
1896. *Eryonidae,* Ortmann, Zool. Jahrb. vol. 9, pp. 427, 428.
1899. *Eryontidae*, Alcock and Anderson, Ann. Nat. Hist., ser. 7, vol. 3, p. 289.
1901. *Eryonidae*, Alcock, Catal. Deep-Sea Crustacea, Macrura and Anomala, p. 164.

Alcock supplies a full account of the characters of the family, and gives a synopsis of the genera belonging to "the Indian Necton and Benthos." These genera are *Polycheles* Heller, 1862, *Pentacheles* Bate, 1878, *Eryoneicus* Bate, 1882, and *Willemoesia* Grote, 1873.

### Gen.: Polycheles, Heller.

1862. *Polycheles*, Heller, Sitzungsber. K. Akad. Wiss. Wien, vol. 45, p. 389.
1863. *Polycheles*, Heller, Crust. südlichen Europa, p. 209.
1880. *Polycheles*, Smith, Proc. U.S. Mus. for 1879, p. 346.
1888. *Polycheles*, Bate, Challenger Macrura, Reports, vol. 24, p. 126.
1888. *Stereomastis,* Bate, Challenger Macrura, Reports, vol. 24, p. 154.
1895. *Polycheles*, Faxon, Mem. Mus. Comp. Zoöl. Harvard, vol 18, p. 117.
1901. *Polycheles*, Alcock, Catal. Indian Deep-Sea Crustacea, Macrura and Anomala, p. 166.

Spence Bate separated *Pentacheles* from this genus on the ground that in the former all the five pairs of legs in both sexes were more or less perfectly chelate, whereas in *Polycheles* the fifth pair of the male was supposed to end in a simple finger. It subsequently appeared, however, that species evidently belonging to *Polycheles* had the fifth pair imperfectly chelate in the male, and that in all the species it was chelate in the female. Alcock now supplies a more important distinction, pointing out that in *Pentacheles* " the epipodite of the external maxillipeds is of fair size; those of the thoracic legs are normal epipodites ascending into the branchial chamber," but that in *Polycheles* " the epipodite of the external maxillipeds is a mere papilla; those of the thoracic legs are merely membranous expansions of the base of their podobranchiæ." When Professor S. I. Smith described the Nova Scotian *Polycheles sculptus* he admitted that he could not distinguish it from the Figian *Pentacheles auriculatus*, Bate, of which the characters had at that time been only briefly indicated. In his Challenger Report, Bate transferred the latter species to a genus *Stereomastis*, which, he says, " differs in nothing externally from *Pentacheles*, but is established to receive those species in which the mastigobranchial lash does not exist." But that, as Alcock now explains, is the very character on which the separation between *Polycheles* and *Pentacheles* must best be grounded. Faxon, however, unites both *Pentacheles* and *Stereomastis* with *Polycheles*, remarking that " an examination of a large number of species discloses a gradual transition in the development of the epipods, from large, well-developed organs through small, delicate and thin ones, to merest rudiments in the shape of small expansions at the base of the stem of the gill."

### Polycheles sculptus, S. I. Smith.

1880. *Polycheles sculptus*, Smith, Proc. U.S. Mus. for 1879, p. 346, pl. 7.
1899. *Pentacheles sculptus*, Alcock and Anderson, Ann. Nat. Hist., ser. 7, vol. 3, p. 239.
1901. *Polycheles sculptus*, Alcock, Catal. Indian Deep-Sea Crustacea, Macrura and Anomala, p. 170.

Alcock gives the synonymy, which includes *Polycheles spinosus* A. Milne-Edwards, 1880, and the name *Pentacheles sculptus*, which has been used both by Professor Smith himself and by Alcock and Anderson. The specimen from South Africa closely agrees in all external particulars with the minutely-detailed account given by the original describer, except that between the rostral spines and the cervical groove the median carina of the carapace has not only 1 + 2 + 1 spines, but an additional spine immediately behind the last of these. In *Polycheles phosphorus*, Alcock, the part in question carries 1 + 1 + 2 + 1 spines, but

has at the outer angle of the basal joint of the first antennæ only one denticle instead of the two found in *P. sculptus*, the chelipeds also showing some differences. In Professor Smith's specimen of *P. sculptus* the sublateral carina between the cervical groove and hind margin had also 5 small spines on one side and six on the other. The South African specimen has five on each side. Smith speaks of the longitudinally-furrowed carina of the sixth pleon segment as "inconspicuous," an epithet inapplicable to it in our specimen. In the fifth pair of legs the finger is notably longer than the thumb, which, though short, is quite distinct. The colouring (in formalin) shows on the carapace three rose-coloured areas, one central in the front of the cervical groove, and the other two behind it, lateral, of long triangular shape; the ground is a pale dull orange.

Dimensions:—Carapace in median line, 56·25 mm.; lateral margin, 63·75 mm. long; greatest breadth in front of cervical groove, 43·75 mm.; length of pleon, 70 mm.; of second antennæ, 70 mm. Total extension from apex of second antennæ to apex of telson, about 8 inches. Length of first chelipeds, nearly 140 mm., reaching, therefore, if fully extended considerably beyond the second antennæ, but as preserved they are strongly geniculate between the third and fourth joints.

Locality:—Cape Natal N. by E. (approx.) 24 miles. Depth, 440 fathoms. Bottom, mud.

## Fam.: Palinuridae.

1888. *Palinuridae*, Bate, Challenger Macrura, Reports, vol. 24, p. 74.
1891. *Palinuridae*, Ortmann, Zool. Jahrb., vol. 6, p. 14.
1893. *Palinuridae*, Stebbing, History of Crustacea, p. 195.
1897. *Palinuridae*, Ortmann, American Journal of Science, vol. 4, p. 290.
1900. *Palinuridae*, H. Woodward, The Geological Magazine, Decade 4, vol. 7, p. 394.
1900. *Palinuridae*, Stebbing, Marine Investigations South Africa, Crustacea, part 1, p. 29.

Ortmann in 1897 recognizes seven genera, which he arranges in three groups—1 *Palinurellus, Jasus*; 2 *Palinurus, Palinustus, Linuparus*; 3 *Panulirus, Pucrulus*. Of these he says "the first may be called the more primitive, the second the typical, the third the more advanced group." Of *Palinustus* A. Milne-Edwards, 1880, he remarks that it "comes very near to Palinurus, and differs only in the weaker 'frontal horns,' which are placed on the outer edge of two very peculiar plates projecting horizontally from the frontal margin and truncated squarely at the apex." In regard to the fossil species described and figured

by Dr. Woodward as *Linuparus vancouverensis* (Whiteaves) and *L. canadensis* (Whiteaves) there is this difficulty, that the rostral part is defective, so that it is not clear why the species should be referred to *Liniparus* rather than to *Jasus*. It should be noted that the generic names *Serex* Pfeffer, *Avus* Ortmann, and *Puer* Ortmann, were discarded from this family by the last named author in 1897 for very sufficient reasons.

### Gen.: Jasus, Parker.

1883. *Jasus*, Parker, Nature, vol. 29, p. 190.
1884. *Jasus*, Parker, Trans. New Zealand Inst., vol. 16, p. 304.
1888. *Palinosytus*, Bate, Challenger Macrura, Reports, vol. 24, p. ix.
1888. *Palinostus*, Bate, Challenger Macrura, Reports, vol. 24, pp. ix., 85.
1891. *Jasus*, Ortmann, Zool. Jahrb., vol. 6, pp. 14, 16.
1893. *Jasus*, Stebbing, History of Crustacea, p. 197.
1897. *Jasus*, Ortmann, American Journal of Science, vol. 4, p. 291.
1900. *Jasus*, Stebbing, Marine Invest. S. Africa, Crustacea, part 1, p. 30.

T. J. Parker instituted *Jasus* only as a subgenus, but subsequently claimed priority for it over Bate's *Palinostus*. Bate substituted *Palinosytus* for *Palinostus* on the ground that A. Milne-Edwards had employed *Palinustus* for the name of a new Scyllarid, distinct from Bate's *Palinosytus* and near to *Palinurus*.

### Jasus lalandii (Milne-Edwards).

1837. *Palinurus lalandii*, Milne-Edwards Hist. Nat. Crust., vol. 2, p. 293.
1843. *Palinurus lalandii*, Krauss, südafrik, Crust., p. 53.
1884. *Jasus lalalandii*, Parker, Trans. New Zealand Institute for 1883, p. 297.
1888. *Palinostus lalandii*, Bate, Challenger Macrura, Reports, vol. 24, p. 86, pl. 11, fig. 1, pl. 11A, pl. 12, fig. 1.
1891. *Jasus lalandii*, Ortmann, Zool. Jahrb., vol. 6, p. 16.

Dr. Ortmann includes in the synonym the Chilian *Palinurus frontalis* of Milne-Edwards, loc. cit., p. 294, the *P. paulensis* from St. Paul in the Indian Ocean, Heller, 1862, which Heller himself had subsequently recognized as a young form of *lalandii* (Novara Crustacea, p. 98), and the *P. edwardsii*, Hutton (Trans. N.Z. Inst., 1875, p. 279), from New Zealand and Tasmania.

A distinguishing specific character is that the segments of the pleon are furrowed and almost or altogether covered with flattened squamiform tubercles. The colour (in formalin) is a rich red brown, according to Milne-Edwards irregularly spotted with yellow, but the pale markings are at least sometimes symmetrically arranged. The telson and adjacent parts show a fine purple. Krauss states that when alive it is dark green, with reddish and yellow spots, but that it becomes red in drying, or when kept in spirit. Milne-Edwards gives the length of the body as 15 inches; Krauss says it attains a length of 13 inches by a breadth of four and a half. The second antennæ are of great length, at least as long as the body.

Locality :—Hermanuspetrusfontein, Caledon District, near False Bay.

### JASUS PARKERI, n. sp.

### PLATE 7.

The rostrum is not very large, acute, upturned in advance of the clasping processes. The frontal horns are divergent, acute, with smooth margins, followed by two pairs of teeth slightly converging backward; a little behind these is a median tooth, followed by two parallel rows of submedian teeth, eight in a row, slightly graduated, the smallest at the hind margin of the carapace, all pointing upward and a little forward. On the outer side of each eye is a strong outstanding tooth, with a small subsidiary tooth on the upper part of its base; the next lateral tooth has an interrupted outer margin, and level with this there is a small tooth on the surface of the carapace behind the eye; the third lateral tooth is also large, but this is followed by a series of small teeth, twelve to fourteen on each side, not quite symetrically arranged. Close over the sinuous hind margin is a series of minute tubercles, and some granules appear scattered above these, but otherwise the general surface is smooth, nor is there any well-marked cervical groove.

The first five pleon segments have a median carina, most strongly marked on the first three, the first, which is also the shortest, with a forward and upward-pointing tooth, the fourth with a minute, the fifth with a well-marked apical tooth. Each segment forms a large lateral tooth, of which the upper margin is serrate in the first segment, smooth in the rest; above this a boss in the first segment rises to the carapace, and there is a small denticle in the second; all but the first have a smaller lower tooth, and all clasp a little pleural tubercle of the following segment between two points. The sixth segment has two pairs of submedian teeth near the base and an apical median tooth, with a strong additional tooth over the peduncle of the uropods. The telson has four pairs of teeth diverging along the calcareous

part which ends in sharp lateral points, the membranous portion both of this and the uropods being slightly roughened.

The first antennæ have the first joint longer than the second and third together, the third about twice as long as the second, and rather longer than the inner flagellum; the outer flagellum is shorter than the inner, stouter at the base, and strongly setose on its inner margin. The second antennæ have the epistomial base deeply grooved in the middle. If this be taken to represent the first two joints of the peduncle, then the third (or first free) joint has two teeth on the outer, one on the upper, one on the inner side, with some serration also on the inner margin; the fourth joint has about 12 teeth in various sequences, and the fifth fourteen of various sizes. This peduncle does not reach the end of the third joint of the first antennæ; the flagellum is 9 inches long.

The five pairs of trunk legs are all simple and slender, decreasing in stoutness and increasing in length from the first to the fifth pair. The fourth joint is shorter in the first pair than in the second and in the second than in the third, but without sensible difference of length in the fourth and fifth. On the other hand, the length of the sixth joint sensibly increases from the first to the fifth pair, while it is considerably stouter in the first than in any of the succeeding pairs. The sternal plastron between these from a narrow base widens greatly, with a longitudinal median series of five teeth and two submedian on its hind margin. Laterally each of its divisions has two decided teeth, widest apart in the last division, and there more clearly than in the others, accompanied by some small denticles.

Of the pleon segments, the first one carries ventrally two sublateral teeth on its hind margin. The four pairs of pleopods are delicate oval plates fringed with short setæ. The uropods reach a little beyond the telson; the outer ramus is rather longer and broader than the inner.

The colour of the specimen in formalin is orange and orange-red, the flagella of the first antennæ, the fifth and sixth joints of the trunk limbs of the membranous part of the caudal fan, and the ventral surface of the pleon, except on the hind margin of each segment, being pallid.

The length from rostrum to end of telson is about four and a half inches, the carapace measuring 42 mm. by a breadth of 26 mm.; the telson 24 mm. by 15 mm.

Locality:—The single specimen—a male—was taken by shrimp trawl, Buffalo River north 15 miles. Depth, 310 fathoms. Bottom, coral and mud.

The specific name is given out of respect to the late Mr. T. J. Parker, who instituted the genus. To the remarkable armature of this beautiful species there is no resemblance, so far as I know, in any other living Palinurid hitherto described.

## Fam.: Callianassidae.

1900. *Callianassidae,* Stebbing, Marine Investigations South Africa, Crustacea, pt. 1, p. 38.
1901. *Callianassidae,* Alcock, Indian Deep-Sea Crustacea, Macrura and Anomala, pp. 151, 197.

### Gen.: Callianassa, Leach.

In connection with the description of *Callianassa kraussi* (South African Crustacea, p. 38, 1900) notice was taken of numerous species of this genus. It may here be worth while to add that Say's *Callianassa major* was in 1866 transferred by Stimpson to a new genus *Callichirus,* chiefly, as it seems, on the ground that the inner branch of the uropods is "very narrow, almost styliform." At the same date Stimpson instituted another new genus, *Glypturus,* with "caudal lamellæ deeply sculptured," for the species *G. acanthochirus,* which he distinguishes from *Callianassa grandimana* Gibbes, only by details of the cheliped. To these two species of *Glypturus* Miss Rathbun in 1900 adds a third, *G. branneri.* Recently Mr. Lanchester has described a new *Callianassa* from the Malay Peninsula as *C. secura* (Proc. Zool. Soc. London, p. 555, 1902), closely related to *C. pachydactyla,* A. Milne-Edwards, and *C. amboinensis,* de Man.

In a paper on the decapod crustacea of West Africa, also in 1900, Miss Rathbun keeps distinct *Callianassa turnerana,* White, from *C. diademata,* Ortmann, the former being described as having a three-spined rostrum, the latter one that is five-spined. But it may be doubted whether this minute distinction in these large forms, exactly agreeing in the large chelipeds and the trilobed telson, is sufficient for the maintenance of Dr. Ortmann's species. *C. turnerana* is said to be at times prodigiously numerous, so that there may well be opportunity for small individual variations.

### Callianassa rotundicaudata, n. sp.

### Plate 8.

The carapace is about two-sevenths of the total length of the body, the front being feebly advanced between and at each side of the bases of the first antennæ; its hind margin is fringed with some setules. The first two segments of the pleon are coalesced, and together are as long as the carapace, with no trace of pleopods; the third segment, which is half as long, carries at each distal corner a tuft of setæ, thickened with short, close-set plumosity; the two following shorter segments have similar tufts of setæ near the middle. The sixth segment is fringed laterally with setules, and has two rows of setæ on the hind margin. The

telson is almost circular; its hind margin is fringed with setæ, two groups longer than the rest being inserted within the margin, and another group above the middle of the dorsal surface.

The eye-plates are somewhat triangular with the inner margins adjacent, and the pigmented portion at a little distance from the apex.

The first antennæ have the third joint considerably longer than the first and second together, and the flagella somewhat longer than the second and third joints together, these two joints and the slender inner flagellum having long plumose setæ. A setose slit forms the opening to the auditory apparatus of the first joint.

The second antennæ have a peduncle about as long as that of the first pair, the fifth joint slightly shorter than the fourth, the flagellum slender, longer than the peduncle, but not very elongate.

The cutting edge of the mandible is divided into ten or eleven small teeth, increasing in size from the ends of the row towards the middle of it.

The third maxillipeds have the third and fourth joints expanded, the third longer than broad, with a comb of minute teeth on the inner surface nearer to the outer than the inner margin; the fourth joint is broader than long, and widens distally; the fifth and sixth joints are subequal, longer than wide, each with a close-set group of spines on the inner surface; the seventh joint is narrower, rather shorter and blunt-ended.

In the larger first cheliped the fourth joint has a tooth proximally, and is then cup-shaped on the outer surface, but on the inner is much widened; it is a little longer than the preceding joint, which is widest distally; the fifth joint is nearly as wide as long, about as wide as the sixth, but only half as long; in the sixth the thumb is two-sevenths of the length, much narrower than the movable finger, with no gap between them. In the smaller cheliped the fourth joint is rather shorter than the preceding but wider, with no tooth; the fifth joint is shorter than the sixth, but longer than the palmar portion of it, the latter being not greatly longer than the narrow setose fingers.

The second chelipeds are very similar to those of *Callianassa kraussi*, but the following pair differ considerably from that species, the oval sixth joint having no backward produced lobe, and the finger, though laminar, being narrowly triangular. The fourth pair of feet are separated at their bases by a sternal plaque trilobed in front and bifid behind. These and the following pair are constructed much as in *C. kraussi* and *C. subterranea* (Montagu).

The pleopods on the third, fourth, and fifth pleon segments have the usual character, the fringing setæ being minutely plumose, and appearing as if consisting of numerous jointlets. The retinaculum is distally fringed with close-set, tiny spines.

The uropods have the inner branch oval, longer than the telson but narrower, the outer reaching beyond the inner, though scarcely so long; the outer branch fully as wide as the telson; both branches thickly fringed with long plumase setæ, and the outer with a surface row of spinules near the distal margin.

Length, 19 mm. A single specimen.

Locality:—St. Francis Bay. Lat., 34° 2′ 45″ S.; long., 25° 10′ 00″ E. Depth, 30-34 fathoms.

The specific name refers to the shape of the telson. From *C. subterranea*, which in several respects it approaches, the species is distinguished by the much longer palm of the great cheliped, the differently-shaped fingers, and apparently by the much smaller process of the fourth joint, the differently-placed dentate crest of the third maxillipeds, and the much smaller size of the animal. From *C. pachydactyla*, A. Milne-Edwards, it is distinguished by the dentate fourth joint of the larger first cheliped, and the elongate fifth joint of its smaller companion.

## SCHIZOPODA.

1885. *Schizopoda*, Sars, Challenger Schizopoda, Reports, vol. 13.
1900. *Schizopoda*, Stebbing, Proc. Zool. Soc. London, p. 537.

### Fam.: Lophogastridae.

### Gen.: Lophogaster, M. Sars.

1857. *Lophogaster*, M. Sars, Forhandl. Skand. Naturf., Möde i Christiania, 1856, p. 160.
1885. *Lophogaster*, G. O. Sars, Challenger Schizopoda Reports, vol. 13, p. 14.

### Lophogaster typicus, M. Sars.

1857. *Lophogaster typicus*, M. Sars, Forhandl. Skand. Naturf, Möde i Christiania, 1856, p. 160.
1862. *Ctenomysis alata*, Norman, Rep. Brit. Assoc., 1861, p. 151.
1862. *Lophogaster typicus*, M. Sars, Christiania Universitets-program, pp. 1-37, pl. 1-3.
1885. *Lophogaster typicus*, G. O. Sars, Challenger Schizopoda, Reports, vol. 13, p. 14, pl. 1, figs. 1-7.
1892. *Lophogaster typicus*, Norman, Ann. Nat. Hist. ser. 6, vol. 9, p. 459.

The references are taken from the last two authorities. Professor G. O. Sars describes three specimens from south of the Cape. One of these was a male, 25 mm. (an inch) long, with only three teeth on the outer margin of the antennal scale. The specimen now noted measured at least an inch, and has four teeth on the outer margin of the scale. The distal part of the telson was unfortunately broken off. The bipinnate branchiæ add much to the beauty of this species as the series is visible at each side of the translucent carapace, and two rows at right angles to the others meet along the centre of the ventral surface. Sars has called attention to the curious circumstance that this schizopod, first known from Norway and the Shetland Isles and then from the neighbourhood of the Cape, so far remains unknown from intermediate waters.

Locality:—Cape St. Blaize, N.E. by N. ¼ N. 11½ miles. Depth, 40 fathoms. Bottom, sand and rock.

## STOMATOPODA.

1852. *Squilloidea*, Dana, U.S. Expl. Exp., vol. 13, Crustacea, p. 614.
1876. "*Stomatopoden*," Claus, Unters. geneal. Crustaceen-Systems, p. 70, etc.
1883. *Squillacea*, Boas, Morphologisches Jahrbuch. vol. 8, p. 574.
1885. *Stomapoda*, Carus, Prodromus Faunæ Mediterraneæ, vol. 1, p. 464.
1886. *Stomatopoda*, Brooks, Challenger Stomatopoda, Reports, vol. 16.
1893. *Stomatopoda*, Stebbing, History of Crustacea, p. 279.
1894. *Stomapoda*, Alcock, Ann. Nat. Hist., ser. 6, vol. 13, p. 409.
1894. *Stomatopoda*, Bigelow, Proc. U.S. Mus., vol. 17, p. 490.
1895. *Stomatopoda*, Hansen. Isop. Cumac. und Stomatopoden Plankton-Exp., p. 64.

The name *Stomapoda* of Latreille is far older than the term *Stomatopoda*, but the latter has the advantage of keeping in mind Latreille's authorship, without perpetuating the confusion involved in the group as he understood it.

### FAM.: SQUILLIDAE.

As this is the only family at present assigned to the order, the above references will be a sufficient guide to the sources of information, which are numerous.

## Gen.: Squilla, Fabricius.

1793. *Squilla,* Fabricius, Ent. Syst., vol. 2, p. 511.

Without setting forth the copious references to this genus in its enlarged and restricted acceptations, I will recommend the reader to consult Dr. Bigelow's paper above cited, only here taking from it the generic diagnosis :—

"Stomatopoda having the telson attached to the sixth abdominal segment by a movable joint; the hind body depressed and wide; the dactylus of the raptorial claw with usually not more than six teeth; as a rule, more than four intermediate denticles on the telson, which is usually longer than wide; and the inner basal spine of the uropod the longer of the two."

### Squilla armata, Milne-Edwards.

1837. *Squilla armata,* Milne-Edwards, Hist. Nat. Crust., vol. 2, p. 521.
1849. *Squilla armata,* Nicolet, Gay's Hist. de Chile, Zool., vol. 3, p. 223.
1880. *Squilla armata,* Miers, Ann. Nat. Hist., ser. 5, vol. 5, p. 26.
1891. *Squilla armata,* Bigelow, Johns Hopkins Univ., Circ., 88.
1894. *Squilla armata,* Bigelow, Proc. U.S. Mus., vol. 17, p. 515, figs. 9 and 10 in text.

I borrow the references and accept the specific name from Dr. R. P. Bigelow's excellent account of the species. With some reason he appends a note of interrogation to its identification with the form named by Milne-Edwards and Gay. Milne-Edwards only says, "this species is extremely near to Squilla mantis, from which it is distinguished by the absence of crests on the carapace, and by the presence of two spiniform teeth on the upper face of the ophthalmic ring; the claws have seven teeth; length, three inches and a half; habitat, the coasts of Chili." Dr. Bigelow's specimens were from various stations off the coast of Patagonia, had the dactylus of the raptorial claw "armed with seven to nine teeth, rarely six," and varied in length from 60 to 122 mm.; they are described as having the "carapace with median carina obsolete or entirely absent, intermediate and lateral carinæ present on the posterior lateral lobes, anterior lateral angles produced into acute spines." In the South African specimen there is one pair of distinctly marked though not strongly raised carinæ, and the dactylus of the claw has six teeth in addition to the terminal tooth. Apart from the above-mentioned carinæ, it agrees in all respects with Dr. Bigelow's description, and the telson, which he figures, is in this species rather peculiar. It has "a crest and a keel and a series of curved lines of pits on each side, six marginal spines, the submedian pair

with movable tips, no submedian denticles, ten to eleven small intermediate ones, and one lateral one." Each lateral and intermediate spine has a small tooth adjacent to its base on the inner side. Between the submedian spines the margin is divided by a deep median sinus into two rounded or somewhat quadrate, usually smooth, lobes.

Length, from tip of rostrum to apex of submedian spine of telson, 82.5 mm.

Locality:—Cape Point Lighthouse N.W. by W. ½ W. 7¾ miles. Depth, 45 fathoms. Bottom, broken shells and a little mud.

## Gen.: Lysiosquilla, Dana.

1852. *Lysiosquilla*, Dana, U.S. Expl. Exp., vol. 13, Crustacea, p. 615.
1894. *Lysiosquilla*, Bigelow, Proc. U.S. Mus., vol. 17, p. 502.
1895. *Lysiosquilla*, Hansen, Isop. Cumac. und Stomatopoden Plankton-Exp., p. 73.

As observed by Miers and others, the earlier name *Coronis*, Latreille, is preoccupied. Bigelow supplies the more important references and the following diagnosis:—

"Stomatopoda having the sixth abdominal segment separated from the telson by a movable joint; the hind body depressed, loosely articulated and wide; the dactylus of the raptorial claw without a basal enlargement, but with not less than five marginal teeth; no more than four denticles, and often only one, between the intermediate and submedian marginal spines of the telson, which is usually wider than long; and the outer spine of the basal prolongation of the uropod usually longer than the inner one."

*Erichthus Duvaucellii*, Guérin, Iconographie, Crustacés, p. 19. (*Erichthus Duvaucellii*, on pl. 24, fig. 3) is recognized by Brooks as the *Lysioerichthus* and by Hansen as the *Lysierichthus* larva of *Lysiosquilla maculata*.

### Lysiosquilla maculata (Fabricius).

1793. *Squilla maculata*, Fabricius, Ent. Syst., vol. 2, p. 511.
1793. *Cancer (Mantis) arenarius*, Herbst, Krabben und Krebse, vol. 2, pts. 3, 4, p. 96, pl. 33, fig. 2.
1837. *Squilla maculata*, Milne-Edwards, Hist. Nat. Crust., vol. 2, p. 518, pl. 26, figs. 11-15.
1852. *Lysiosquilla maculata*, Dana, U.S. Expl. Exp., vol. 13, Crustacea, p. 616.
1877. *Lysiosquilla maculata*, Miers, Proc. Zool. Soc. London, p. 138.
1880. *Lysiosquilla maculata*, Miers, Ann. Nat. Hist., ser. 5, vol. 5, pp. 5, 125, pl. 1, figs. 1, 2.

1886. *Lysiosquilla maculata,* Brooks, Challenger Stomatopoda, Reports, vol. 16, pp. 45, 110, pl. 10, figs. 1-7, pl. 11, figs. 4, 5.

1894. *Lysiosquilla maculata,* Bigelow, Proc. U.S. Mus., vol. 17, p. 508.

1895. *Lysiosquilla maculata,* Hansen, Isop. Cumac. und Stomatopoden Plankton-Exp., p. 74.

1898. *Lysiosquilla maculata,* Borradaile, Proc. Zool. Soc. London, p. 37.

Herbst gives a reference to Rumph's *Squilla aremaria terrestris,* "Rumph. Mus. tab. 3, fig. E.," which Milne-Edwards cites as tab. 4, fig. E., while Fabricius refers to "Cancer arenarius, Rumph. Mus. tab. 3, fig. 2," and Bigelow quotes Rumph. Amboin. Rarit., p. 6, 1705. Rumph in his Amboinsche Rariteitkamer, p. 4, gives the alternative names *Locusta* or *Squilla Arenaria Terrestris*, and the species is represented full size on his plate 3, fig. E. Herbst adduces Cancer arenarius, etc., from "Linn. Mus. Adolph. Frid., p. 86," a work of 1754. Linnæus himself in 1758 gives the same reference for *Cancer mantis*, followed by a reference to "*Rumph. Mus. t.* 3, *f. E.*, C. Arenarius." Since this habitat includes the Asiatic, Indian, and Mediterranean Seas, the Linnean species may be taken to cover *Squilla mantis* as well as *Lysiosquilla maculata.* The specific name which Herbst adopts with proper respect to his Dutch predecessor has generally been set aside as of later date than that given by Fabricius, but, so far as can be known, they are contemporary, for although Herbst's second volume is dated 1796, the parts of it in which *Cancer* (*Mantis*) *arenarius* was published belonged to 1793. In the conflict of claims the Fabrician name may be allowed a prescriptive preference.

This large and striking species cannot be identified simply by the transverse blue bands, since they are found also in *Squilla vittata,* Milne-Edwards, which Miers, following the lead of Milne-*vittata,* Milne-Edwards, which Miers, following the lead of Milne-Edwards himself, identifies with the earlier *Squilla* (now *Lysiosquilla*) *glabriuscula*, Lamarck. The latter has the dactylus armed with only 5·7 teeth, and sometimes fewer, whereas *L. maculata* has from 8·10. Herbst's figure, though coarsely executed, gives a very good general idea of the appearance.

The specific name chosen by Fabricius evidently refers to the colouring of the telson, for he speaks of "the last segment apically dark, with two whitish marginal spots." This is quite correct, but the broad distal dark-blue band is so much broken by the two white spots that the effect produced would rather lead one to speak of 3 blue spots. In Herbst's figure they are quite separated,

but not entirely in our specimen. The telson has a medio-dorsal triangular elevation, and is broadly truncated, with only two spines on either side above the truncation, between which and the lower spines there is a faint projection of the margin. The rostral plate is, as described by Milne-Edwards, cordiform and very pointed.

Length, 175 mm., or 7 inches from apex of rostrum to distal margin of telson.

Locality:—"Squilla procured at Durban (from Durban Museum)." A specimen nearly twelve inches long, sent me by Mr. W. R. Forrest from Antigua, differs from the form above described in not having the rostral point produced, in having the fifth pleon segment denticulate along the hind margin, except at the centre, the sixth denticulate in an arched proximal band and round the distal margin, and the telson with three spines on each side, and the truncate portion cut into five square teeth on one side and six on the other side of a small median emargination. Milne-Edwards, in his description, says that the hind margin of the telson is armed with three little obtuse "dentelures" on each side of a little median emargination. We may infer, therefore, that the species is subject to some variation in minor details.

## ISOPODA ANOMALA.

### Fam.: Apseudidae.

1896. *Apseudidae,* Sars, Crustacea of Norway, vol. 2, pt. 1, p. 5.
1902. *Apseudidæ,* Harriet Richardson, Trans. Connect. Acad. Sci., vol. 11, p. 280

### Gen.: Apseudes, Leach.

1813. *Apseudes,* Leach, Edinburgh Encyclopædia, vol. 7, p. 404.
1880. *Apseudes,* Sars, Arch. Naturv., vol. 7 (1881), extract, p. 7.
1886. *Apseudes,* Norman and Stebbing, Trans. Zool. Soc. London, vol. 12, part 4, p. 80.
1901. *Apseudes,* H. Richardson, Proc. U.S. Mus., vol. 23, p. 505.

From the references given numerous others can be obtained, both for the family and the genus.

### Apseudes grossimanus, Norman.

1870. *Apseudes grossimanus,* Norman, Proc. Royal Soc., p. 157.
1886. *Apseudes grossimanus,* Norman and Stebbing, Trans. Zool. Soc. London, vol. 12, part 4, p. 93, pl. 19.

This species is distinguished by its tridentate rostrum and the sharp tooth on each side of the carapace behind the distally rounded ocular processes. A female specimen, measuring fully 17 mm., had the marsupium bulging with numerous rather large eggs. The species has previously been taken in 90 fathoms off the south-west coast of Ireland, and in 748 fathoms off the Portuguese coast. The South African specimen above mentioned was taken in 245 fathoms, Table Mountain east 41 miles. Other specimens, also females, with the eggs showing a light red colour, were taken at a depth of 125 fathoms, Lion's Head S. 82° E. 27 miles.

## ISOPODA GENUINA.

### Fam.: Cirolanidae.

1900. *Cirolanidae,* Stebbing, Willey's Zoological Results, Part 5, p. 628.

The above reference will furnish several others to works of importance by H. J. Hansen and others on this family. It may, however, be added that in the Proc. Acad. Philadelphia, p. 187, 1891, Mr. J. E. Ives appends to his description of *Cirolana magara,* n. sp. a list of 33 species of *Cirolana* which had been named up to that date. This list was obviously drawn up before the additions and corrections published by Hansen in the preceding year with regard to this family could have come under the author's notice. It has its own independent value.

A new genus, *Calopisthus,* is added to the family by Miss H. Richardson in the Trans. Connect. Acad., vol. 12, p. 289, 1902.

### Gen.: Cirolana, Leach.

1818. *Cirolana,* Leach, Dict. Sci. Nat., vol. 12, p. 347.
1900. *Cirolana,* Stebbing, Willey's Zool. Results, Part 5, p. 629.

### Cirolana venusticauda, n. sp.

Plate 9.

1843. ? *Cirolana sculpta* (not Milne-Edwards), Krauss, Die südafrikanischen Crustaceen, p. 66.

Body about thrice as long as broad, by help of antennæ and uropods nearly parallel-sided. Head much broader than long,

not deeply immersed in peræon, hind margin less wide than the slightly arched front, which has a well-marked process between the first antennæ. First peræon segment the longest, with hinder angles strongly rounded, the front ones squarely produced forward. Hind margins of the first four segments of peræon and first of pleon smooth, the rest tuberculate, almost imperceptibly on fifth peræon segment, on the others successively with greater prominence, the fifth pleon segment having also on each side of the centre a strong tubercle in advance of the hind margin. The telsonic segment carries anteriorly a median carina beginning with a small tooth or prominence and ending in a large one, this being followed by two pairs of tubercles, of which the surface has in addition one or two at the base on each side of the carina, and many of various sizes along each margin. The slightly sinuous sides, where free from the uropods, are fringed each with seventeen spines in sets of six and eleven, interspersed with short plumose setæ, the narrowly rounded apex having a similar armature of four spines and accompanying setæ. Of the second and third peræon segments, the side-plates do not reach the hind margin of their respective segments, and in the former case are narrower behind than in front; in the other segments the side-plates have the hind margin produced backward, and agreeing as to sculpture with the hind margin of the segment, those of the seventh overlapping the first two segments of the pleon. The third pleon segment is the widest, and the fourth is wider than the fifth.

The eyes are dark in formalin, roughly rounded, of moderate size, with numerous small components.

First antennæ—The peduncle is clearly three-jointed, shorter than the flagellum, which has seventeen joints furnished with hyaline filaments.

Second antennæ—The first three joints of the peduncle are short, the fifth is longer than the fourth; the flagellum, about twice as long as the peduncle, attains to thirty-one joints.

The frontal lamina surmounting the epistome widens to the convex anterior border, from which it bends to meet the rostral point with an angular termination.

The mouth-organs, as will be seen from the figures, are in tolerably close agreement with what is usual in the genus. In the first maxillæ attention may be called to the little projecting horn on the outer side of the inner plate. Such a process is figured by Hansen for *Cirolana borealis* Lilljeborg, but not for *Cirolana elongata* Milne-Edwards, nor for his own *Cirolana minuta,* nor do I find it in *Cirolana orientalis* Dana, which has in its place a minute spine, in agreement with *Cirolana japonica* Hansen; the process is feebly developed in *Cirolana pleonastica* and *Cirolana albicaudata,* which I have recently described.

First gnathopods—These are rather robust, the fourth joint fully as broad as long, with two rows of spines along the inner

margin, the short trianglar fifth joint underriding the sixth and having its base deeply imbedded in the fourth. The finger is shorter than the sixth joint, and as in all the trunk limbs has a short, dark-coloured nail, preceded by a small spine, which gives a biunguiculate appearance to the joint.

Second gnathopods—The spines on inner margin of fourth joint are arranged in two sets separated by an unarmed interval; the fifth joint is small, but does not underride the sixth, nor is it imbedded in the fourth; the sixth joint is much less stout than in the preceding pair.

Peræopods—The first pair is similar to the second gnathopods The other four pairs have the joints longer, especially the last two pairs which are subequal. There are no plumose setæ on these limbs, but spines at the apices, and a few on the inner margins of the third to sixth joints.

Pleopods—The rami are broad in all of them.

Uropods—The peduncle is produced rather beyond the middle of the telsonic segment, but not quite to the middle of the inner ramus; this ramus is very broad, and reaches beyond the segment, its margin, except near the base, being closely fringed with spines and setæ; the outer ramus, though about as long as the inner, does not reach nearly so far back, and is much narrower, but with similar armature. Colour, in formalin, cream, with symmetrical brown markings on upper surface, but not on under surface or on appendages, except the uropods. Length, 15 mm., or a little less or more.

Locality:—Table Bay, and from "Red Bait" (a large Ascidian), Somerset West, shore.

Krauss, loc. cit., under *C. sculpta,* M.-Edw., says, "A species distinguished by the exceedingly pretty marking of the abdomen, which I have found in Table Bay. Yellowish green, with black speckles and spots. Length, 6 lines." Herklots in 1851 merely mentioned the name on Krauss's authority. Hansen doubts the identification, and is disposed to think, from the strong sculpturing of the pleon, that Milne-Edwards's species may be a *Corallana.* Milne-Edwards thus describes his *C. sculpta*:—"Head much broader than long, scarcely narrowed anteriorly, and little immersed in the thorax. Margin of the last thoracic rings and of the rings of the abdomen finely denticulate. The last segment of the abdomen furnished with a conical tooth on the median line, with a multitude of little crests, and ending behind acutely. Feet feeble, and scarcely hairy. Terminal plates of the uropods almost of the same size and apically acute. Length, about 9 lines. From the coast of Malabar."

The description of the uropods will not at all suit the present species, and the distance of habitat does not encourage the hypothesis of misdescription. Milne-Edwards also says that in his species the head is scarcely narrowed in front: in the South

African species it is plainly widened. The new specific name for the latter alludes to Krauss's remark upon the beautiful marking of the pleon.

CIROLANA FLUVIATILIS, n. sp.

This species is closely allied to *Cirolana pleonastica*, described and figured in "Willey's Zoological Results," Part 5, p. 629, pl. 67A, 1900. Between the mouth organs of the two there seems to be no difference on which to lay any stress. It may, however, be mentioned that in the present species, out of the thirteen setæ fringing the inner plate of the second maxillæ, eight instead of three are conspicuously plumose, and in the maxillipeds the terminal joint narrows distally instead of widening. The antennæ are more distinctive, for here in the first pair the first two joints are clearly separate, the first distally widened, the third is as long as the preceding two combined; the flagellum consisting of ten or eleven unfurnished joints, is as in the other species equal in length to the peduncle; in the second pair the peduncle is a little longer than the first antennæ, its fifth joint is clearly longer than the fourth, the flagellum is more than twice as long as the peduncle, and consists of about forty joints, varying from under to over that number, of the earlier joints some fourteen or fifteen carrying rather conspicuous little tufts of setæ.

The surface of the peræon is somewhat pubescent, especially at the sides; the hind rim of the seventh segment carries about eighteen tubercles. Of the pleon, the third, fourth, and fifth segments have the hind margin tuberculate, the fourth has its sides strongly produced over the produced and rounded sides of the fifth, the produced lobes of the fourth having the peculiarity of a lateral slit, such as might be expected to indicate two segments in coalescence, of which there is here no question. The telsonic segment is triangular, with straight sides, the breadth at the base equal to the median length. At the upper part of each side there is a small ridge, and on either side of the middle line there is a partial carina formed in two or three sections, beginning near the base, but not reaching the narrowly-rounded apex, the ornamentation being thus a kind of link between that of *C. sulcata* and *C. pleonastica*. The lower half of the segment is fringed with plumose setæ, among which are four spines at the apex, and two on each side in notches above the apex, not as in *C. pleonastica*, eight together round the apex. The inner ramus of the uropods reaches beyond the telsonic segment, and is not a very broad oval, but broader and longer than the outer ramus. Colour (in formalin) uniform, a dull pinkish brown, probably not to be relied upon as characteristic. Size, 12 mm. long, by 4.5 mm. broad.

Locality:—Two miles up the Buffalo River. This is described as a tidal river. The specific name alludes to the place of capture.

*C. pleonastica* was obtained at depths of 60 and 100 fathoms in Blanche Bay, New Britain.

1890. *Cirolana sulcata*, Hansen, Cirolanidæ, Vid. Selsk., ser. 6, vol. 3, p. 336 (100), pl. 2, fig. 5-5e.

This species, fully described and excellently figured by H. J. Hansen, is easily recognized by the peculiar sculpture of the telsonic segment, which has a medio-dorsal longitudinal furrow between two stout carinæ, which meet at their extremities.

Locality:—Somerset West, shore; from "red bait."

The specimens described by Hansen were taken in Simon's Bay.

### Fam.: Ægidae.

1879. *AEgidae*, Schiödte and Meinert, Naturhistorisk Tidsskrift, ser. 3, vol. 12, p. 325.
1890. *AEgidae*, Hansen, Vid. Selsk. Skr., ser. 6, vol. 3, p. 315 (79).
1893. *AEgidae*, Stebbing, History of Crustacea, p. 347.

### Gen.: Rocinela, Leach.

1818. *Rocinela*, Leach, Dictionnaire des Sciences naturelles, vol. 12, pp. 348, 349.
1849. *Acherusia*, Lucas, Crust. Algérie, p. 78.
1867. *Rocinela*, Bate & Westwood, Brit. sessile-eyed Crustacea, vol. 2, pt. 17, p. 289.
1879. *Rocinela*, Schiödte and Meinert, Naturhistorisk Tidsskrift, ser. 3, vol. 12, p. 380.
1893. *Rocinela*, Stebbing, History of Crustacea, p. 348.
1897. *Rocinela*, Sars, Crustacea of Norway, vol. 2, p. 65.

### Rocinela dumerilii, Lucas.

1849. *Acherusia Dumerilii*, Lucas, Crust. Algérie, p. 79, pl. 8, fig. 3.
1864. *Acherusia complanata*, Grube, Die Insel Lussin und ihre Meeresfauna, p. 76.
1879. *Rocinela Dumerilii*, Schiödte and Meinert, Nat. Tidsskrift, ser. 3, vol. 12, pp. 383, 391, pl. 12, figs. 4-9.
1886. *Rocinela Dumerilii*, Bovallius, Bihang till K. Svenska Vet. Akad. Handlingar, vol. 12, pp. 383, 391, pl. 12, figs. 11-19.

The South African specimen is not in absolute accord with the figures given either by Lucas or by Schiödte and Meinert in one

particular, for the head is strongly produced in front into a somewhat upturned rotundo-quadrate process, the sides of which are even a little incurved before diverging towards the eyes. From the authors mentioned one must infer that the process in their specimens, though more or less blunt at the top, was otherwise triangular.

The nearest approach in other described species of *Rocinela* to the shape of the process exhibited by the African specimen is in *R. oculata*, Harger, 1883, but that species is distinguished from *R. dumerilii* by being much broader in comparison with the length, by having the eyes contiguous instead of separated, and by having the inner ramus of the uropods slightly shorter than the outer, instead of distinctly longer. According to Bovallius, in the adult male of *dumerilii* the front of the head "shows an obtuse projection shorter than in the ovigerous female, but longer than in the virgo." Grube distinguished his *Achcrusia complanata* from *dumerilii* only on the ground that its first pleon segment did not run out into strongly-produced joints, such as are shown in the figure given by Lucas, and the same distinction might be drawn for the African specimen, in which the first pleon segment is much less wide than those that follow, although its apices are sharper than theirs, but Schiödte and Meinert explain that in the ovigerous female the first pleon segment is in fact almost entirely concealed, though in the "virgo" it is broad and pretty fully uncovered. In their account they say that the tarsus (sixth joint) of the prehensile feet has three sharp spines in the ovigerous female, four in the "virgo." In the African specimen the joint in question has four spines, and the Danish authors figure four for both forms.

The eyes are large and dark, composed of about 140 ocelli, the facets easily catching the light. The well-marked medio-dorsal depression on the head, described by Lucas, is present. On the other hand, the longitudinal furrow on the telsonic segment which he says is pretty well marked, is rather to be imagined than perceived. Schiödte and Meinert speak of it as "lightly" shown in the ovigerous female, and "very lightly" in the "virgo." The colouring and size (an inch long), and all details except the frontal process, so well agree with earlier descriptions and figures of *R. dumerilii* that it would be rash to form a new species for this single specimen.

Locality :—Vasco de Gama Pt. S. 75° E. 13½ miles. Depth, 166 miles.

## Fam.: Cymothoidae.

1900. *Cymothoidae*, Stebbing, South African Crustacea, Part I, p. 55 ; and Willey's Zool. Results, Part 5, p. 639.

## Gen.: Nerocila, Leach.

1818. *Nerocila,* Leach, Dict. Sci. Nat., vol. 12, p. 351.
1880. *Nerocila,* Harger, U.S. Fishery Report for 1878, Part 6, p. 391.
1881. *Nerocila,* Schiödte and Meinert, Nat. Tidsskrift, ser. 3, vol. 13, p. 4.
1887. *Nerocila,* Bovallius, Bihang till K. Svenska Vet-Akad. Handlingar, vol. 12, pt. 4, No. 4, p. 3.
1893. *Nerocila,* Stebbing, History of Crustacea, p. 351.

Additional references, including the synonyms *Ichthyophilus,* Latreille, and *Emphylia,* Koelbel, will be found in Schiödte and Meinert.

### Nerocila cephalotes, Schiödte and Meinert.

1881. *Nerocila cephalotes,* Schiödte and Meinert, Nat. Tidsskrift, ser. 3, vol. 13, p. 60, pl. 4, figs. 16-18.

In this species the head is broadly rounded in front, and behind fitted into the trilobate front margin of the first peræon segment. The angles of the sixth and seventh peræon segments are produced, acute, reaching beyond the still more acute apices of their side plates. The lateral angles of the first and second pleon segments much overlap those of the third and fourth segments, and in all four to a lateral view they have a somewhat hook-like shape. Our specimen is a female, with distended marsupial plates.

Locality:—Cape St. Blaize N. 4¼ miles. Depth, 35 fathoms. Bottom, mud. Found on Synaptura pectoralis. Schiödte and Meinert examined a specimen from Cape Agulhas and another from the Cape of Good Hope, besides others.

## Fam.: Idoteidae.

1900. *Idoteidae,* Stebbing, South African Crustacea, pt. 1, p. 51.
1901. *Idoteidae,* H. Richardson, Proc. U.S. Mus., vol. 23, p. 537.

For the synonymy see Part 1, p. 51, of the present work. To the references there given may be added *Idoteidae,* H. Richardson, The American Naturalist, vol. 34, p. 224, 1900, and *Les Idotées,* H Milne-Edwards, Le Règne Animal, Edition par les Disciples de Cuvier, Crustacés, p. 201, pl. 69, date uncertain. Of the last work, published by Fortin, Masson et Cie, it should be remarked that the plates ought not to be neglected by the carcinologist, although the accompanying volume of text is of a very mean order. Here also it may be well to call attention to the circumstance that Guérin-Méneville, in his Iconographie du Règne Animal de G Cuvier, a work vaguely dated 1829-1843, thinks the explana-

tion of the plates a fitting opportunity for describing a new genus and species, *Edotia tuberculata* from the Falkland Islands, and no less than three new species of *Idotea* from the Cape of Good Hope, all of these unfigured, and consequently a source of trouble to succeeding authors. The species assigned to *Idotea* are named *I. Latreillii, I. Edwardsii, I. distincta.* From Miers' revision of the family, however, it does not appear that any one of these three names can be retained, since with no little probability he identifies the first with *I. indica*, Milne-Edwards, the second with *Oniscus ungulatus*, Pallas, the third with *I. peronii*, Milne-Edwards.

From the following accounts it will be seen that within this family the mouth-organs present some interesting variations. Thus in *Glyptidotea* and less conspicuously in *Paridotea* the maxillipeds are seven-jointed, in *Idotea* they are six-jointed, in *Synidotea* five-jointed, in *Colidotea* four-jointed. These differences depend on coalescence occurring or not occurring between the fourth and fifth joints of the "palp," or between its second and third joints, or between both those pairs, and in case of *Colidotea* the first joint, in addition, loses its identity by coalescence either with the second joint of the stem or the second of the palp. In *Paridotea ungulata* I now incline to think that the second and third joints of the palp should be separately reckoned, though it is a point rather difficult to determine. In the same way the second and third joints in *Idotea indica* are far less distinctly separated than they are in *Idotea balthica*. The first maxillæ also show some curious differences in minute details. *Paridotea ungulata* has on the inner plate of these appendages five plumose setæ (not six, as stated on page 54 of Part I.) in *Glyptidotea* as in *Idotea* there are three, and in *Synidotea hirtipes* only two.

### Glyptidotea, n. g.

Side-plates distinct in all peræon segments except the first. Pleon consisting of a single segment, with three pairs of lateral sutures at the base. Sculptured joints in peduncle of both pairs of antennæ. Second antennæ with the flagellum multi-articulate. Maxillipeds seven-jointed. All the trunk limbs more or less subchelate, the penultimate joint most dilated in the first pair.

By the sculpturing of the head and the strongly prehensile character of the limbs, the type species of this genus recalls *Glyptonotus*, while in other characters it resembles *Idotea* and *Synidotea*, but from all hitherto defined genera of the Idoteidæ it appears to be distinguished by its distinctly seven-jointed maxillipeds and its pleon sutures. The generic name is compounded in allusion to the mixture of characters.

## Glyptidotea lichtensteinii, Krauss.

### Plate 10.

1843. *Idotea lichtensteinii*, Krauss, Die südafrikanischen Crustaceen, p. 62, pl. 4, fig. 4.
1881. *Idotea Lichtensteinii*, Miers, Journ. Linn. Soc. London, vol. 16, p. 64.

The front of the head is trisinuate, the median notch small and overhung by a large, blunt-ended, horizontal process of the dorsal carina, the lateral angles produced into blunt points directed slightly outwards in advance of the small, black, dorso-lateral, triangularly-rounded eyes, behind which the lateral margins converge to the faintly-concave hind border. The first peræon segment is short in the middle, but with the sides reaching forward to the eyes, flanking the head with broadly rounded plates, of which, however, the inner and the hinder margins are flattened. Of the six following segments the side-plates are all distinct, in shape passing from oval to sub-quadrate, not produced backward, but matching the length of the segment, which is least in the seventh and greatest in the second and third, the latter with its side-plates presenting the greatest breadth. The pleon has a length equal to the first three segments of the peræon, the breadth at the base being not much less than the length, and nearly two and a half times the width of the apex, which is shallowly emarginate with rounded corners. The three pairs of sutures are dorsally successively shorter; ventrally they are very distinct. A median carina extends from the cephalic process on to the pleon, where it loses the rather moderate acuteness of its earlier portion, and near the middle of the segment bifurcates, being very faintly continued to each apical angle.

First antennæ—The first joint is deeply cut into several unequal lobes, among which is implanted the narrow stalk of the second joint; this in turn is divided into lobes at its widened distal extremity, receiving the shorter third joint, which also forms a little cup for the narrow base of the flagellum. The latter has the shape of a blade-bone, and has its convex margin closely set with fourteen semi-circular lobes, from each of which projects a pair of hyaline sensory filaments and two setules, or perhaps from the last two semi-circles there may be only one filament apiece. It is possible that these marginal divisions with their apparatus indicate a coalescence of many articulations to form this peculiarly shaped one-jointed flagellum.

Second antennæ—The first joint short; the second much wider, cut into deep lobes which encircle the third joint, this also being wide and lobed, but less strongly than the preceding, the fourth joint oblong, a little longer than wide, the fifth abruptly narrower, considerably longer; the flagellum longer than the peduncle, con-

sisting of seventeen joints, of which the first is the longest and the last minute, all apically fringed with inconspicuous setules.

Epistome strongly produced forward, its linguiform process being just concealed by the nasiform process of the head in a dorsal view, the narrow arms flanking the upper lip, which is triangular above and has the slightly convex lower margin covered with a thick moustache. Lower lip—The rotundo-quadrate lobes are rather strongly setulose. In the stomach near the entrance are two dark reniform masses very strongly setulose round the adjacent inner and the hinder margins. These correspond to what in the Amphipoda I have called organs of trituration, but which Professor Della Valle names "cardiac folds." In the Amphipoda they are often armed with numerous and powerful spines. The exterior of the stomach is covered like the rest of the animal with little scale-like markings.

Mandibles—The left mandible has the middle tooth of its cutting plate simple, but the tooth on each side deeply bifid; in the secondary plate there is one strong, horny-looking triangular tooth, and three spine-like teeth, two of them short; there are four or five crowded plumose spines in the spine-row, the molar is strong, with setules at the base, the oval crown setulose, a little serrate above, accompanied by a projecting group of setæ. The right mandible has two simple teeth and a third feebly trifid in the cutting plate, the secondary plate divided into feeble spine-like teeth, the crown of the molar serrate along one edge.

First maxillæ—The outer plate is surmounted by eleven crowded spines, the outermost but one being the strongest, the innermost six slender, forming two sets, each consisting of three graduated spines. The inner plate has three plumose setæ on the narrow apex.

Second maxillæ—The outermost plate has seven pectinate spines; the middle plate carries six; the considerably broader inner plate is distally fringed with several plumose setæ.

Maxillipeds—The inner margin of the first joint forms a rounded process beset with plumose setæ; its external part forms a broad base for the large distally narrowed epipod. The second joint is elongate, its apical process, distally fringed with setæ, reaches beyond the second joint of the palp, and somewhat above its base has a strong spine-hook, nearly at the level reached by the apex of the epipod. The first joint of the palp is small, the second widened, cup-like, with the inner margin much longer than the outer, the third joint similar but larger, and with less difference between the two margins; the fourth joint is much the longest, oval, but with truncate apex, on which is placed the small, but very distinct, oval fifth joint, this like the three preceding joints having setæ on the inner margin.

First gnathopods—Though the seven pairs of trunk limbs are all very similar in character, the first pair have certain distinctive features. They are the shortest, and have the sixth joint

shorter, and absolutely as well as relatively wider than it is in the other pairs; also on its outer surface this joint is armed with a great number of pectinate spines, which are wanting in the other pairs. The second joint is deeply channelled along the front, the third and fourth joints are distally widened, lobed on each side; the fifth joint is very short, not under-riding the sixth; the sixth obtains a subchelate character by help of a strong sub-basal spine confronting the finger, this spine being to appearance roughened with rows of minute teeth extending from near the base quite to its apex. The finger is biunguiculate, groups of setules or slender spines attending the stronger outer nail and the shorter inner one.

Second gnathopods and the peræopods—There is a gradual increase in the length of the limbs, the sixth joint becoming narrower and longer, but the differences otherwise not being very material. In all the limbs the peculiar denticulate spine of the sixth joint is conspicuous, and the finger shows an impression on the inner surface where its base rests against the circular apex of the sixth joint.

The pleopods do not seem to differ from those in the genus *Idotea*.

The uropods—These also are in close agreement with those of *Idotea*. The ramus is more than a third of the length of the peduncle, at its base nearly as broad as the length, which is greater on the convex outer than on the straight inner margin, the apical being obliquely truncate and faintly emarginate, rather more than half the basal breadth. There is no other plate, but a strongly plumose setæ about half as long as the ramus, and by this possibly the outer ramus is represented.

The colour in formalin is orange, with a pair of bright red spots on the front margins of the peræon segments from the second to the seventh. Small spots and stellate markings are visible under the microscope on many parts, including the maxillipeds, uropods, etc.

Length, about 24 mm. The single specimen carried numerous eggs within the four pairs of marsupial plates, and could not be flattened out for minutely exact measurements. Krauss gives the size of the specimen taken in the algæ of Table Bay as length 1 inch, breadth 3·7 lines.

Locality:—Dredged between Bird Island and the mainland, Algoa Bay, in 10 to 16 fathoms, on a bottom of sand, shells, and stone.

### Gen.: Synidotea, Harger.

1878. *Synidotea*, Harger, Amer. Jour. Sci., ser. 3, vol. 15, p. 374.
1880. *Synidotea*, Harger, U.S. Fisheries Report for 1878, pt. 6, p. 350.

1881. *Edotia* (part), Miers, Journ. Linn. Soc. London, vol. 16, p. 65.
1885. *Synidotea*, Sars, Norwegian North Atlantic Exp., vol. 14, p. 116.
1895. *Stenosoma*, Dollfus, Feuille des Jeunes Naturalistes ser. 3, Année 25, No. 292, p. 9.
1897. *Synidotea*, Benedict, Proc. Acad. Philadelphia, p. 390.
1899. *Synidotea*, H. Richardson, Proc. U.S. Mus., vol. 21, p. 847.
1900. *Synidotea*, H. Richardson, American Naturalist, vol. 34, p. 227.
1901. *Synidotea*, H. Richardson, Proc. U.S. Mus., vol. 23, p. 541.

Of this genus an excellent little monograph was published by Dr. J. E. Benedict in 1897. He assigns to it fifteen species, and gives figures of the thirteen which had come under his own observation. The genus may be defined as follows:—

Sides of head in a dorsal view entire and not laterally produced. Side-plates of peræon coalesced with the segments. Pleon consisting of a single segment, with one pair of lateral sutures at the base. Eyes lateral. Second antennæ with well developed multi-articulate flagellum. Maxillipeds with three-jointed palp, or in other words, maxillipeds five-jointed. Uropods with a single branch.

Dr. Benedict distinguishes two sections of the genus, the first having the distal end of the pleon emarginate or bicuspid, the second having the end bluntly pointed.

Miss Richardson, in her analytical key to the genera of *Idoteidae*, assigns to the group including *Synidotea* the character of having the "legs all ambulatory." In *S. hirtipes*, however, the first pair are shorter and stouter than the rest, with expanded penultimate joint and reflexible finger constituting a prehensile hand. Also they close so firmly upon the mouth that their ambulatory function has probably been relinquished.

## Synidotea hirtipes (Milne-Edwards).

1840. *Idotea hirtipes*, Milne-Edwards, Hist. Nat. Crust., vol. 3, p. 134.
1843. *Idotea hirtipes*, Krauss, Die Südafrikanischen Crustaceen, p. 61.
1881. *Edotia hirtipes*, Miers, Journ. Linn. Soc. London, vol. 16, p. 68.
1897. *Synidotea hirtipes*, Benedict, Proc. Acad. Philadelphia, p. 403.

On the description given by Miers, and quoted by Benedict, little criticism is needed, but Miers says, without reserve, that the legs are long and slender, whereas the first pair are rather short and stout. Also he speaks of the distal emargination in the telsonic segment as small and shallow. It seems to be variable.

but is usually broad and often well marked. The last three segments of the peræon are notably shorter than the rest, and the demarcation of the side-plates is very faint. In the uropods the peduncular plate has on its upper half two obliquely transverse ridges fringed with spines like those along the margin, and at the apex of its hinge margin it has two plumose setæ.

The first antennæ have the first joint short and wide, the rest narrow, the flagellar joint being about as long as the second and third joints of the peduncle combined, widening a little from its base, then tapering, fringed with about 18 pairs of filaments.

The epistome is much wider above than below, produced upward to a short median triangular point, its lower margin straight, scarcely so wide as the upper lip, which is proximally as well as distally fringed with seta-like spines, those projecting from the distal margin being very closely set; the margin itself is unsymmetrically bilobed. The lobes of the lower lip are also rather strongly fringed on the inner margin.

The mandibles have the basal part double-ridged and the extremity geniculate. The cutting plate is four-toothed, the secondary plate tridentate, its teeth horny-looking on the left mandible, slighter, pellucid, and a little setulose on the right. No spine-row was perceptible. The molar is prominent, with oval denticulate crown.

The first maxillæ have the outer plate surmounted by ten, or sometimes by eleven, spines, some of which are denticulate, none very powerful. The inner plate is narrow at both ends, and has at the apex only two setæ, which are rather long, and, as usual, plumose.

The second maxillæ have some of the spines on the inner plate plumose, those on the middle plate finely pectinate, about fifteen in number.

The maxillipeds have the first joint short, the epipod nearly parallel-sided, not reaching the apex of the process of the second joint, though extending considerably beyond the first joint of the palp; its upper margin slopes inward. The process of the second joint is shaped as commonly in the Amphipoda Gamanaridea, and similarly fringed with setæ on the inner and apical margins, but here it is tied to its fellow, each member of the pair carrying a strong spine-hook for grappling the other. The first joint of the palp is small and rather obscure, the second is very large, widening distally, its distal margin flatly rounded on the inner part and externally forming a little free projection. The third joint is also very large, its inner margin almost continuous with that of the preceding joint, feebly convex, fringed with short spines, its outer margin strongly convex, fringed with seta-like spines, some of which also stand out from the surface.

The character of the first gnathopods has been already noticed in remarks on the genus.

In the first pleopods the peduncle is fringed with a dozen hooked spines. The male stilet of the second pair is produced considerably beyond the rami. None of the rami show any transverse suture.

Locality:—Specimens were taken at three stations—Cape St. Blaize

W. $11\frac{1}{2}$ miles, 27 fathoms, fine sand; and Cape St. Blaize N.W. $3\frac{1}{4}$ miles, 33 fathoms, mud.

Miss H. Richardson's genus *Colidotea* is distinguished from *Synidotea* by having only two joints to the palp of the maxillipeds, and the side-plates distinct and well-developed in the last three segments of the peræon. The first joint of the maxilliped palp in *S. hirtipes* is so faintly marked that in this respect it may be regarded as a link between the two genera. On the other hand, the side-plates of the peræon segments are scarcely discernible.

In his key to the species of *Synidotea*, Dr. Benedict was unable to include *S. hirtipes* (Milne-Edwards) and the var. *laevidorsalis* (Miers), a larger, narrower form from Japan, neither of which he had seen. But he incidentally recognizes that they belong to the first of the two sections into which he divides the genus. Within this section *S. hirtipes* makes the nearest approach to *S. laticauda*, Benedict, of which Dr. Benedict remarks that "the valves of the operculum are diagonally crossed by a curved line." As already noticed, in *S. hirtipes* the valves of the opercular uropods are crossed by two such lines. No one observing one of them could well fail to notice the other, so that this may be taken as a distinctive mark separating *S. hirtipes* from *S laticauda*, which is also a broader form. Miers, it is true, does not make any reference to the second line in *S. hirtipes*, but possibly it might not attract attention in the dried specimens which he examined. In the var. *laevidorsalis* he figures the opercular valve with only one line which points to the conclusion that this Japanese form is specifically distinct.

### Idotea indica, Milne-Edwards.

1840. *Idotea Indica*, Milne-Edwards, Hist. Nat. des Crustacés, vol. 3, p. 131.

1843. ? *Idotea Latreillii*, Guérin-Méneville, Iconographie du Règne Animal, Crustacés, p. 32.

1881. *Idotea indica*, Miers, Journ. Linn. Soc. London, vol. 16, p. 50, pl. 2, figs. 4, 5.

This species bears a rather close general resemblance to *Idotea emarginata*, Fabricius, but is distinguishable from it by the rather sinuous and less convergent sides of the telsonic segment, and by the side-plates of the peræon. Miers says that these latter parts are "small, in the second segment occupying, in a lateral view,

only the anterior half of the lateral margins, in the second and third segments the middle portion of the lateral margins, in the fifth and sixth segments they reach nearly, and in the seventh segment quite, to the postero-lateral angles."

His description was taken from the type in the Paris Museum, "an adult male," 40 mm. long. It agrees well with our specimen, which appears to be a female, being without the male appendages on the seventh peræon segment and the second pleopods. The side-plates are obviously quite different from those of the male *I. emarginata*, but they also differ very considerably from those of the female of that species, which Sars (Crustacea of Norway, vol. 2, p. 85, pl. 35, fig. 2) describes and figures as "rather small and not contiguous." It is important to remember the striking dissimilarity between the side-plates in the two sexes of the species in question, although I find that at least sometimes they may be contiguous in the female as well as in the much larger male, whereas in *Idotea indica* there is no approach to contiguity, the whole series being well separated.

Miers gives the flagellum of the second antennæ as eighteen-jointed, and states that the last peræopods have "their penultimate joints thickened and considerably elongated." In his figure this is a very notable feature, and may be a characteristic of the adult male. In our specimen the flagellum of the second antennæ has on one of the pair fifteen and on the other sixteen joints; the last peræopods are not very strikingly larger than the penultimate pair.

The mouth-organs are in near general agreement in most respects with those of the type species of *Idotea*, the *I. balthica* (Pallas), as recently figured by Sars. In both species it seems to me that the upper lip has a small emargination which Sars does not indicate, and that the lobes of the lower lip are more squared than in his figure. In both species the inner plate of the first maxillæ carries at the apex three plumose setæ, but its shape is not quite the same as both, the widening being near its junction with the stem in *I. balthica*, but higher up in *I. indica*. The most notable difference is in the maxillipeds, for these in *I. balthica* have the palp very distinctly four-jointed, whereas in *I. indica* the dividing line between its second and third joints is only faintly discernible, except at the edges, nor does our specimen show any trace of the notch near the apex of the fourth joint, which at least sometimes in *I. balthica* marks the place at which a small fifth joint is lost in coalescence with the fourth. The epipod is oval. The outer apex of the second joint of the stem carries four setæ, its process is armed with one hooked spine.

Length, 27 mm.

Locality:—Hout Bay, from a depth of 9 to 20 fathoms, on fine sand and broken shells.

## FAM.: SPHAEROMIDAE.

1840. "*Sphéromiens,*" Milne-Edwards, Hist. Nat., Crust., vol. 3, p. 197.
1847. *Sphaeromidae,* White, List of Crustacea in Brit. Mus., p. 102.
1900. *Sphaeromidae,* Stebbing, Proc. Zool. Soc. London, p. 552.
1901. *Sphaeromidae,* Harriet Richardson, Proc. U.S. Mus., vol. 23, p. 532.
1902. *Sphaeromidae,* Harriet Richardson, Trans. Connect. Acad. Sci., vol. 11, p. 291.

In the Proc. Zool Soc. London for 1900 a list of authorities on this family is given, and it is scarcely necessary to repeat it here.

### Gen.: EXOSPHAEROMA, Stebbing.

1900. *Exosphaeroma,* Stebbing, Proc. Zool. Soc. London, p. 553.

### EXOSPHAEROMA AMPLIFRONS, n. sp.

PLATE 11.

The head, which is slightly notched at the summit, is remarkable for the wall-like steepness with which it rises in front far above the eyes. A small triangular rostrum separates the cavities from which spring the bases of the first antennæ, and, on either side of these a small wing or hollowed surface of the head lies below the greatly projecting eye-lobes.

The peræon is broad, strongly imbricated, a deep cavity being formed by the dorsal slope of the first segment and the postero-dorsal slope of the head. The side-plates of the last six segments are rather abruptly bent downwards and even a little inward, the last three ending less acutely than the preceding three. The infero-lateral margin of the first segment forms an acute angle at either end, in front helping to embed the eye-lobe, behind slightly under-riding the side-plate of the second segment. A very notable peculiarity of the species is furnished by the eroded appearance caused by little pits in the integument. These are conspicuous on the lower part of the head and its adjoining appendages, over much of the first peræon segment, on all the side-plates and hind margins, and over a great part of the pleon. In the last three peræon segments the hind margins are cut into several blunt denticles, of which there are two, not always very distinct, on each of the three preceding segments.

The pleon is very strong featured, its basal portion being produced into prominent submedian bosses, and the terminal portion also having two that are even more prominent, overhanging the triangular telsonic portion, the apex of which is somewhat trilobed and curves upward beyond two little notches. There are two tufts of setules on the underside of the apex, and the mediolateral parts of the pleon are setulose. The basal portion shows four components, the first marked by a sinuous dorsal line, the next two only by lateral sutures, but the second, third, and fourth segments are much broader than the first, and the second has a more extensive lateral margin than the rest, and one which outflanks the side-plate of the seventh peræon segment.

The eyes are dark, of irregular shape, tending to oval, with about a hundred small components.

The first antennæ have the first joint much longer than the second and third combined, the second much narrower than the first, broader but considerably shorter than the third. The flagellum of nineteen joints, carrying hyaline filaments, is shorter than the peduncle. The second antennæ are rather longer than the first, with the penultimate joint of the peduncle not shorter than the ultimate, the fifteen-jointed flagellum subequal in length and proximally in breadth to the peduncle.

The epistome and upper lip, as seen in situ with the other "oris partes," and as seen when detached, are shown in the figures. The mandibles are particularly massive, with the palp especially inconspicuous and membranaceous. The cutting edge is very dark, and looks like a single undivided tooth, very blunt. The secondary plate on the left mandible is also dark-coloured, simple but comparatively thin and small; the crown of the molar is light brown in colour, so prominent and so close to the secondary plate that no spine-row could be perceived between them. On the right mandible the secondary plate is divided into slender teeth.

The lower lip has the principal lobes quadrately rounded, rather strongly spinulose, their inner margins indented, the inner lobes pretty strongly developed.

The first maxillæ have the usual four plumose setæ on the apex of the inner plate, these setæ slightly increasing in length from the outer to the innermost. On the outer plate nine horn-coloured spines surmounted the apex on one maxilla, and ten on the other.

The second maxillæ have what I suppose to be the exopod very distinctly represented by a rather long, narrow lobe of the outer margin; of the three plates, the innermost has some plumose spines mixed with the others, while on the middle and outer plates there are to each about ten thin graduated spines.

The maxillipeds have the plate arising from the second joint more than twice as long as broad, with the greatest breadth

beyond the middle, the apical border a little oblique. Each plate has a strong coupling spine. Of the five joints of the palp the first is small, the second large, the others successively smaller, the second to the fourth produced into narrow lobes, apically tufted with setæ, like the narrow unlobed fifth.

First gnathopods—These are distinguished from the following six pairs of trunk-limbs by the triangular shape of the fifth joint, and its position overlapped on the outer side by the apical lobe of the fourth, and on the inner side under-riding the sixth joint. On the inner margin the fourth and sixth joints have each five, and the fifth has four spines, which are plumose in such a way as to give a hand-like appearance to the upper shorter ones. The finger is biunguiculate, with a seta between the outer and the shorter inner unguis. In the other limbs, the fifth joint, though smaller than any of the rest, except the finger, is similar in shape, armature, and mode of articulation to the fourth.

Pleopods—The inner apex of the peduncle has not more than three or four spines with bent tips. The male appendage of the second pair reaches a little beyond the margin of the ramus, and is blunt-ended. The sutured plate of the fifth pair is distally squamose, its projecting bosses being especially conspicuous in this respect. This character is perhaps general in the Sphæromidæ. In shape and relative dimensions the rami of the pleopods seem to show some differences from species to species, but whether the differences are stable and really specific I am not in a position to say.

Uropods—The peduncle has a strong ridge on the upper side. The fixed inner ramus is oval, setulose on its margins, and has an apical tooth directed a little outward. The movable outer ramus is longer and broader, with irregular outline, the upper surface hollowed, carrying a row of setules, the under surface having two such rows ; the apex is tridentate, the middle tooth large and prominent.

Length about twice the breadth. The largest specimen, if it would submit to be unrolled, might be 16 mm. long. The smallest differed from the largest and from the one figured, which was 12.5 mm. long, in slightly bent posture, and 7.5 mm. broad, by having the telsonic apex simple, not trilobed, and by having much reduced lobes on the basal part of the telson.

Locality :—Between Bird Island and mainland, Algoa Bay, in a depth between 10 and 16 fathoms, on a bottom of sand, shells, and stones. The extraordinary appearance of the head has suggested the specific name of this remarkable form.

## Exosphaeroma validum, n. sp.

### Plate 12A.

The head of this species is distinguished from that of *E. amplifrons* chiefly by the want of any eccentric elevation above the eyes, its upper line in a front view being gently convex instead of forming an almost pointed arch.

The peræon is broad, with the imbrication even more strongly marked than in *E. amplifrons*, the transverse ridges occasionally carrying four widely spaced low tubercles, which, however, were obsolete in the specimen figured. The integument is not at all eroded. The segmentation of the pleon is as in the preceding species, but here the basal part has two tubercles instead of great bosses, and the terminal part, though it carries two large bosses surmounted by two tubercles, ends in a commonplace manner, the apical margin being truncate and shallowly trifid like the British form known as *Sphaeroma prideauxianum*.

The first and second antennæ are distinguished from those of *E. amplifrons* by characters of doubtfully specific value. In the first pair the first joint is more massive, but the angular projection on the side margin is much less prominent. In the second pair the penultimate joint of the peduncle is shorter than the ultimate. That the flagella have a joint or two more than observed in the other species cannot be a matter of importance.

The upper lip on the inner side has the transverse line above the apical margin more prominent, straighter, and carrying stronger setules than in *E. amplifrons*.

The mandibles are less massive than in the species just mentioned, though generally similar, but with the cutting plate more outdrawn, the secondary plate on the left mandible trilobed, obscure, and at most very slight on the right; on both there is a distinct spine-row of five or six spines, some of which are a little denticulate. The molar has on one side above the crown a small appendage, probably common to all the species. The palp is a little stronger than in *E. amplifrons*, but as there, with the joints nearly equal, the second and falcate third fringed with spines, of which two or three at the apex of each of these joints are the longest.

The lower lip and maxillæ are as in *E. amplifrons*, but the maxillipeds have a rather differently-shaped plate to the second joint, its greatest breadth being at the middle, and the apical margin much more oblique. On one of the first maxillæ eleven spines could be counted on the outer plate.

First gnathopods—These are nearly as in the preceding species, but the fourth joint has a row of seven spines with two others out of the row, the fifth has five spines, and the sixth has six. The other limbs may show similar differences, but they are not striking.

The pleopods have from four to three hooked spines at inner apex of peduncle. In the second pair the male appendage in the specimen examined did not quite reach the extremity of the ramus. The central appendages on the seventh segment of the peræon are rather different from those of *E. gigas* (Leach), being closely adjacent and slightly curved.

The uropods differ considerably from those of *E. amplifrons*, being much simpler, the peduncle not ridged above, the fixed ramus the larger, with squared end, the outer ramus shorter, oval, with subacute apex.

The specimen figured is remarkable for the numerous purplish-brown spots with which its dorsal surface is richly sprinkled. Unfortunately, there is no constancy in the colouring of specimens.

Length, 16 mm., breadth, 8 mm.

Locality :—Between Bird Island and mainland, Algoa Bay, Dredged from depth of 10-16 fathoms.

## EXOSPHAEROMA SETULOSUM, n. sp.

PLATE 12B.

The head is nearly as in *E. validum*, but even less raised above the broadly rounded eye-lobes. The whole surface is pubescent, this characteristic showing most distinctly on the hind margins of the peræon segments and on the pleon. The peræon shows a tendency to develop inconspicuous tubercles on the hind margin of the otherwise smooth segments. In the pleon the basal portion has two small tubercles at its hind margin, and the terminal part has two parallel longitudinal ridges stopping considerably short of the depressed trifid apical margin, of which the centre-piece is more advanced than in *E. validum*.

The first and second antennæ are nearly as in *E. validum*, but in the first pair the first joint has the angular projection more prominent, and the flagellum, though consisting of only the same number of joints—twenty-one—is here not shorter than the peduncle. The second pair have a flagellum of eighteen joints as compared with sixteen in the much larger *E. validum*.

The epistome and upper lip show a somewhat different appearance from those of *E. validum*, as will be seen in the figures of these parts as dissected. In the other mouth organs there seem no essential differences, except in the plates arising from the second joint of the maxillipeds, these plates having a length decidedly less instead of greater than twice the breadth.

The first gnathopods have on the fourth joint five spines in a row, on the fifth four, and on the sixth four, but in each case there is an additional spine on one side of the row, and a spinule in front of the series on the sixth joint. Here, as in the preceding

species, the last three pairs of limbs are a little more slender than the three preceding pairs.

The pleopods are nearly as in the preceding species, but no male appendage was discernible on the second pair.

The uropods are as in the preceding species, except that the outer ramus is as long as the inner, with a strong outward-directed apical tooth, and that the whole appendage is strongly fringed with setules.

The specimen figured was ornamented by a narrow transverse purple band near the hind margin of each peræon segment, and by transverse and longitudinal bands on the telsonic segment, but this striking pattern was not repeated on other specimens.

Length of unrolled specimen would be 10 mm.

Locality:—Between Bird Island and mainland, Algoa Bay, dredged from depth of 10-16 fathoms.

The specific name refers to the pubescence on many parts of the integument. Between this species and *E. validum* the alliance is very close, but it has not seemed feasible to attribute all the differences mentioned to conditions of age or sex.

### Exosphaeroma gigas (Leach).

1818. *Sphaeroma gigas*, Leach, Dict. Sci. Nat., vol. 12, p. 346.
1900. *Exosphaeroma gigas*, Stebbing, Proc. Zool. Soc. London, p. 553, pl. 39.

The synonymy of the species is given and discussed in the Proceedings of the Zoological Society for 1900, in combination with that of White's *Sphaeroma lanceolatum*. On the whole, it now seems to me that the two forms ought to be kept specifically separate, and that the names allotted by Leach and White may conveniently stand, although it may not be absolutely certain which of the forms Leach had before him.

The South African specimens appear to be in substantial agreement with those described and figured as *Exosphaeroma gigas* from Mr. Rupert Vallentin's Falkland Island collection, except that in point of size they by no means merit their specific name of *gigas*. They are quite small. The specimen dissected was 9 mm. long by 5 mm. broad, with the male appendages well developed, those on the second pleopods being considerably longer than the rami. The first antennæ have the flagellum 11-jointed, a little longer than the peduncle, and in the second antennæ the flagellum is 19-jointed and considerably longer than the peduncle. These numbers and dimensions contrast with those in the large Falkland Islands specimen, in which the first flagellum is 17-jointed but shorter than the peduncle, and the second has about 16 joints. These flagella, however, are notoriously subject to

much variation, so that the differences noted are of little importance compared with all the numerous points of agreement. The thick fur on the peræopods is a very conspicuous feature.

Locality:—Two miles up Buffalo River, taken with small shrimp net on a muddy bottom.

## Parasphaeroma, n. g.

Fifth and sixth segments of the peræon laterally projecting beyond the rest. First division of the pleon with its first component segment conspicuous, the second overlapping it, and also the seventh segment of the peræon, but not the third of the pleon, of which the second, third, and fourth segments are, as usual, coalesced in the middle; telsonic segment with blunt dorsal process near the middle and shallowly concave emargination of the apex. Epistome elongate, its apex prominent beyond the rostral point of the head and between the somewhat projecting bases of the first antennæ. Second antennæ geniculate between the fourth and fifth joints. The trunk-limbs not bidentate in appearance, a slender spine lying close within the nail. Hind peræopods slender. Last pleopods without conspicuous transverse pleating.

The generic name alludes to the obvious affinity between this and other Sphæromidæ.

This genus agrees with *Dynamene,* Leach, in having a simple excavation of the telsonic apex, but several distinctive marks are presented in the above definition. *Dynamene* itself still remains obscure, the adult male form not having been determined. Bate and Westwood in their discussion of it (British sessile-eyed Crustacea, vol. 2, p. 418) say, "In our figures of the second maxilla in *D. rubra* and *Montagui,* only one of the lobes was observed on dissection." Their figures, however, show that they are referring not to the second but the first maxillæ. Both pairs are normal, as they might easily have satisfied themselves, in the two forms mentioned.

It is possible that Cunningham's *Cymodocea darwinii* if better known might be included in this genus, although that species has the outer branch of the uropods scarcely half as long as the inner, while in the species here to be described the outer branch is fully as long as the inner (see Trans. Linn. Soc. London, vol. 27, p. 499, pl. 59, fig. 1, 1871, and Studer, Isopoda of the Gazelle, p. 18, Berlin, 1884).

### Parasphaeroma prominens, n. sp.

### Plate 13.

The head is much broader than its length, bounded by a slight ridge in front of the eyes, in advance of these being folded

beneath. The first four segments of the peræon are bent sharply downwards at the sides so that in dorsal view the side plates of the second, third, and fourth are inconspicuous, but those of the fifth and sixth segments are more outstanding, so that in folding up the animal does not become smoothly globular. The first division of the pleon has been described in the account of the genus, apart from notice of a central blunt process which overhangs the hind margin of the fourth segment. This and the similar process on the following division seem slightly to vary in relative size, the former being usually the larger, and both becoming very prominent in lateral view when the animal is rolled or folded up. The telsonic segment is broad, widening to the insertion of the uropods, thence with convex sides converging to the apical emargination.

The eyes are large and prominent, their hind margins inserted in the first peræon segment. Their colour (in formalin) is purplish red.

The first antennæ have the usual geniculate joint, followed by a small second joint, which is longer than broad. The slender third joint is longer than the first. The flagellum of 22 joints is longer than the peduncle. It begins with a very short joint, followed by a long one; most of the others carry hyaline filaments.

The second antennæ have a stout peduncle, the first three joints short, the fourth a little shorter than the fifth, which is subequal to the first three combined. The flagellum of 19 joints is longer than that of the first antennæ, and in the first 9 joints much stouter, these, in addition to the apical setæ present on all the joints, having on the sides brushes of elongate setæ—probably a masculine feature.

The epistome is very much longer than the upper lip which it partially embraces with its narrow ends, the elongate trunk having slightly sinuous sides and a rounded top which folds over so as with a more or less pointed return piece to meet the apex of the rostrum. The broad basal joints of the first antennæ are yet kept completely apart instead of meeting, as they do in most Sphæromidæ, at or over the apex of the epistome.

The upper lip has a broad, not quite symmetrically, bilobed distal margin, and on the surface a pair of reticulated clear spaces.

The lower lip has the hinder angles more squared than is usual in this family. The mandibles are strong, the cutting plate divided into three horny-looking teeth, the secondary plate on the left mandible with three horn-coloured teeth, of which the middle one is the smallest, this plate on the right mandible being slighter with the teeth not horn-coloured. The spine-row consists of eight or nine spines closely set, most of them broad. The molar has a rounded crown fringed with teeth and traversed by faintly-marked rows of denticles, having also on the outer side

some seta-like spines. The second and third joints of the paip have numerous spines.

The first maxillæ have on the apex of the outer plate eleven or twelve spines, unequal but all slender, and on that of the inner plate four plumose setæ.

The second maxillæ have several plumose setæ on the innermost plate, all three plates having the usual spine-armature, and the outermost being articulated considerably above the middle one. Near the base of the appendage below the channelled outer margin is a very prominent lobe, fringed with upward curving setules. Such a lobe is often indicated rather than developed in other genera. In the case of *Exosphaeroma amplifrons* the suggestion has already been offered that it represents an exopod.

The maxillipeds are as in *Exosphaeroma*. The plate of the second joint is broad, the processes of the fourth, fifth, and sixth are narrow, and the seventh joint is slender.

The first gnathopods have the fourth joint as long as the third and broader, its inner margin carrying four denticulate spines, of which the small triangular fifth joint has six, and the rather long sixth joint has ten, besides two dozen smaller spines planted well within the margin on the inner surface. Between the margin of the finger and its adjacent spine there is a spinule, as in *Exosphaeroma* and elsewhere, but here these three parts lie in close proximity.

The second gnathopods have the third joint quite as long as the second, and much longer than the fourth, which is even shorter than the fifth. The latter has two or three spines on the inner margin, and within it a close-set row of eight or nine stout spines. The sixth joint is rather large, the upper part fringed with seven stout spines. The unguis is arranged as in the rest of the limbs.

The first peræopod has the second, third, and sixth joints subequal, the sixth a little longer, and the fifth a little shorter than the second or third, the fourth being the shortest of all. The third, fourth, and fifth are fringed on the inner margin with brushes of setæ. The rather elongate finger is furry on its outer margin. The fifth peræopod is more slender than the first, and has its second joint longest, the third, fourth, and fifth subequal, the sixth not greatly shorter than the second, the finger furry as in the first pair, but a little shorter.

The pleopods. The spines on the inner margin of the peduncle of the first three pairs are three in number. The male appendage of the second pair is more elongate than the rami, not acute at the apex. The third and fourth pairs have the outer branch two-jointed. The fourth and fifth pairs have both branches branchial, but not pleated, and in the fifth pair the squamiferous processes are scarcely in relief.

The uropods have the inner unarticulated branch adjacent to

the telson, the rounded end just projecting beyond the emargination of the segment; the equally long outstanding outer branch is apically acute and usually (though not in the specimen figured) rather sickle-shaped at the end.

The colour (in formalin) long retains bright orange red transverse bands, often interrupted in the middle, especially in the pleon being limited to the extent of the transverse sutures.

Length, 19.5 mm. Breadth, 9.5 mm.

Locality:—Vasco de Gama Peak S. 75° E. 13½ miles, at a depth of 166 fathoms.

The specific name refers to the prominence of the epistome.

### Gen.: Cymodoce, Leach.

1814. *Cymodoce,* Leach, Edinb. Encycl., vol. 7, p. 433.
1815. *Cymodice,* Leach, Trans. Linn. Soc. London, vol. 11, p. 368.
1816. *Cymodice,* Leach, Encycl. Brit., Art. Annulosa, p. 427.
1818. *Cymodocea,* Leach, Dictionnaire des Sciences Naturelles, vol. 12, pp. 341, 342.
1868. *Cymodocea,* Bate & Westwood, Brit. Sessile-eyed Crustacea, pt. 20, vol. 2, p. 425.
1891. *Cymodocea,* Ives, Proc. Acad. Philad., pp. 188, 194.
1893. *Cymodoce,* Stebbing, History of Crustacea, p. 362.

Leach, not content with using three different forms of the name of this genus, in the Linnean Transactions misquotes the earliest form of it as *Cymodyce.*

### Cymodoce uncinata, n. sp.

Plate 14.

The head and peræon have no very striking peculiarities, but the tip-tilted pleon is characteristic. In large specimens its surface is rougher than that of the rest of the body, as if covered with minute hexagonal crystals. Its first division extends laterally beyond the side-plates of the seventh peræon segment, having the boundary line of its own first segment almost concealed. Of the three following centrally coalesced segments the first is the broadest, and has the longest lateral margin, but does not overlap the others; the last has two conspicuous submedian teeth projecting over its hind margin. The telsonic segment carries two large, somewhat carinate, submedian bosses, beyond which it is depressed and narrows rapidly to the trifid apex, the centre piece of which is faintly trilobed and carries on its upper surface a reverted lobe or tooth, forming the hook to which the specific name refers.

The eyes are dark, with numerous components, the margin turned towards the side of the head nearly straight, that towards the middle of the head being angularly convex.

The antennæ are normal, the flagellum of the first pair composed of eighteen joints, that of the second stouter and a little longer, with fourteen joints; in this pair the fifth joint of the peduncle is a little longer than the fourth.

The epistome is much broader than long, the apex pointed. The upper lip is rather deep, with broadly rounded outer margin. The mandibles have the characters usual in this genus, the joints subequal. In the first maxillæ eleven spines were counted cutting edge undivided, the palp slight, with its first and second on the outer plate, the inner having the usual four plumose setæ. In the plate of the maxillipeds the greatest breadth is in the upper half.

The first gnathopods, like all the other limbs, have a spine outstanding from the lower apex of the outer margin of the third joint. Owing to the channelling of this joint its outer apex seems to lose its apical position. The fourth joint has five stout and more or less plumose spines on the inner margin, the triangular fifth has four and the sixth has six.

The second gnathopods are considerably longer than the first, and closely resemble the five pairs of peræopods, all having the fifth joint similar to the fourth but shorter, both being spinose along the inner margin and on the outer apex. The sixth joint has spines along the inner margin. The bifid finger is stout. The male organs on the seventh peræon segment are elongate, tapering.

The pleopods have only three hooked spines on inner apex of peduncle. The male appendage of the second pair is much longer than the rami. In the fourth and fifth pairs the branchial ramus is strongly plicated. The covering ramus in the fifth has a transverse suture as in the third and fourth pairs.

The uropods are broad, somewhat hirsute, the movable outer ramus having a little notch at the apex of its outer margin, which is often obscured by the setules; it reaches a little beyond the inner ramus and the telson.

Length of specimen figured, in slightly bent position, 12.5 mm., breadth, 6.5 mm.

Localities:—Table Bay, 22 fathoms. Off Buffalo Bay, 30 fathoms.

## FAM.: CYPRONISCIDAE.

1889. *Cyproniscidae*, Giard and Bonnier, Travaux de Wimereux, Bopyriens, p. 221.

1893. *Cyproniscidae*, Stebbing, History of Crustacea, p. 397.

1900. *Cyproniscidae*, Bonnier, Travaux de Wimereux, vol. 8, p. 190.

## GEN.: CYPRONISCUS, Kossmann.

1884. *Cyproniscus,* Kossmann, Sitzungsberichte K. Akad. Wiss. Berlin, Heft 22, p. 400.
1887. *Cyproniscus,* Giard and Bonnier, Travaux de Wimereux, Bopyriens, p. 220.
1893. *Cyproniscus,* Stebbing, History of Crustacea, p. 397.
1898. *Cyproniscus,* Sars, Crustacea of Norway, vol. 2, p. 232.
1900. *Cyproniscus,* Bonnier, Travaux de Wimereux, vol. 8, p. 191.

Sars gives the following definition of the genus:—

"Body of the adult female forming an inert curved sac wholly filled with ova or embryos, and affixed to the host by the aid of a thin flexible cord; dorsal face convex and exhibiting distinct traces of segmentation, ventral face flattened, lateral parts expanded, anterior extremity broadly produced, posterior obtusely rounded and incurved. Body of immature female sub-pyriform, bluntly truncated in front, hind extremity narrowly exserted, lateral parts not distinctly defined. Body of young female, immediately after the transformation subfusiform, very faintly segmented, front part still enveloped by the larval skin, and deeply immerged within the body of the host, being anchored by a pair of long, flexuous, root-like processes. Adult male exactly resembling the female larva of last stage, being rather slender, and without eyes; hind expansion of basal joint of antennule divided into a restricted number of teeth, coxal plates coarsely pectinate; outer ramus of uropoda much smaller than the inner. Parasitic on Ostracoda."

The single species for which the genus was founded, and on which the above definition is based, was originally described by Sars in 1882 under the name of *Cryptothiria cypridinae*, the specimens having been found infesting *Cypridina norvegica*, Baird. So far as the material permits a decision, the new species about to be described agrees accurately with the generic definition drawn up by Professor Sars, except in one particular. In the new species the outer ramus of the uropoda is very little smaller than the inner.

In the male and last larval stage of female the type species shows the terminal segment with an undivided margin. In the new species the margin is divided into teeth. This character is found also in the larval parasite of *Aega ventrosa*, M. Sars, described by G. O. Sars as "Cryptoniscid No. 2" in the Crustacea of Norway, vol. 2, p. 246, pl. 100, fig. 3. Further, in Hansen's Isopoden, Cumaceen und Stomatopoden der Plankton Expedition, 1895, it appears clearly in the larvæ which he designates *Entoniscus α*, *Boyprus α*, *Bopyrus η*, *Bopyrus ε*. That such a peculiarity should be common to the parasites of Ostracoda, of Isopoda, and of one or more higher Malacostracan groups, is worthy of notice, as one more link connecting the numerous

species which in the ovigerous female attain the most remarkable diversities of form. Professor Sars unites in the single family Cryptoniscidae parasites which MM. Giard and Bonnier distribute among the Cryptoniscidae, Cyproniscidae, Podasconidae, and Cabiropsidae, according as they respectively infest Thyrostraca, Ostracoda, Amphipoda, or Isopoda. The latter arrangement is confessedly provisional, and viewed in that light it may be allowed to have the considerable merit of convenience.

## Cyproniscus crossophori, Stebbing.

### Plate 15b.

1901. *Cypromiscus crossophori*, Stebbing, Knowledge, vol. 24, p. 100.

An ovigerous female, somewhat longer than broad and slightly unsymmetrical, shows no definite division into segments. Of lateral lobes the two or three in the centre are well defined, and from these sutures run both dorsally and ventrally, but without meeting in the middle either of the convex side or the flattened opposite side. Both apices are broadly rounded. The flexible cord is attached high up on the convex surface.

In the last larval stage the animal is somewhat fusiform, with fine striæ across the back. The head is rather narrowly rounded in front, widening greatly to the strongly-produced subacute postero-lateral angles, the under surface of the front showing a reflexed median point. Of the seven segments of the peræon the first is completely overlapped by the angles of the head, the sixth is the widest and slightly the longest; all have denticulate sides. The six segments of the pleon are, together, about as long as the six preceding segments, and taper gradually to the insertion of the uropods, behind which the telsonic part of the sixth segment is triangular with somewhat sinuous sides and a rather rounded apex, the whole margin being cut into fourteen teeth, or twelve, if the uppermost points are not included in the reckoning.

Eyes not perceived and probably absent, in accord with the generic definition. First antennæ adjacent on underside of head; the basal expansion hand-like, showing on the inner side a short thumb and towards the outer side four fingers, and besides these two others not accurately in the same plane, one lying on the first finger, the other projecting between it and the thumb. The second joint is nearly as broad as long, and carries two short branches, of which one at least is tipped with a long seta; the small third joint carries a great tuft of divergent hyaline filaments.

The second antennæ are much longer, with a tapering peduncle of four joints, of which the first is much the stoutest, the second considerably the longest; the slender flagellum is about as long

as the last three joints of the peduncle, its own five joints successively shorter, all these eight joints with a seta a-piece, the last of them with two setæ.

The first and second gnathopods differ from the following limbs by having the fifth joint more prolonged and more strongly under-riding the hand, which is plump and oval, affording a slightly oblique palm for opposition to the short curved finger. The five pairs of peræopods have the wrist or fifth joint very small, the sixth joint somewhat tapering, seemingly with a little notch or spine near the middle of the opposable margin, though these limbs can scarcely be called subchelate, since the finger is straight, except at the extreme apex. In all the trunk limbs the long second joint is attached to a pectinate coxal plate, which is prominent in a ventral view of the animal.

Pleopods. The peduncle is short but broad, its outer part forming a narrow apex, to which the outer ramus is attached; its inner margin, at least in the first pair, carries two apically bent spines; the inner ramus is rather the broader, and has its distal margin armed with five long plumose setæ; the outer ramus has four such setæ and a spine or simple seta on the outer angle.

The uropods have a peduncle as long as broad, and as long as the inner ramus; the latter has a seta at the middle of its inner margin and four setæ on the apex; the outer ramus, which is rather shorter and narrower, has also four on the apex.

The ovigerous female, with eggs not far advanced, was 8 mm. long by 7 mm. broad; the larval form was 2.5 mm. in length, and rather less than three times as long as broad. There were three larvæ in the same Ostracode with the developed female above described, and with a well developed egg of the host, *Crossophorus africanus*. In another female of the same Ostracode a single larva of the parasite occurred.

## CRUSTACEA ENTOMOSTRACA.

### Ostracoda.

### Myodocopa.

### Fam.: Cyprididinidae.

1896. *Cypridinidae*, Brady and Norman, Trans. Royal Dublin Soc., ser. 2, vol. 5, p. 638.

1900. *Cypridinidae*, Stebbing, Willey's Zoological Results, Part 5, p. 662.

Further references are given in the last-mentioned work.

### Gen.: Crossophorus, Brady.

1880. *Crossophorus*, Brady, Challenger Ostracoda, Reports, vol. 1, p. 157.

1888. *Crossophorus*, Sars, Arch. Naturv., vol. 12, p. 182.
1896. *Crossophorus*, Brady and Norman, Trans. R. Dublin Soc., ser. 2, vol. 5, p. 643.

Shell porcellanous, broadly rounded at hinder extremity; antennal notch overhung by subacute rostral processes. First antennæ with second joint longer than third and fourth combined; fifth joint with sensory appendage in both sexes. Second antennæ with three-jointed secondary appendage, its third joint in the male falcate, clasping, in the female continuous with the second joint and ending in a long seta. Mandibles five-jointed, with strongly bifid hairy masticatory process on first joint, and small bisetous exopod on the second. First and second maxillæ about as in *Cypridina*. Maxillipeds six-lobed, the penultimate division forming a large sub-triangular lamina continuous on the inner margin with the small apical lobe. Apex of vermiform appendage variable, the armoured spines on these limbs numerous. Caudal laminæ having stout ungues interspaced with slender ones, the graduation in the length of the ungues being also discontinuous, although continuous for those of similar stoutness, except that the hindermost is shorter than the penultimate.

In his Neapolitan monograph Dr. G. W. Müller dismisses this genus as insufficiently described (p. 174, 1894). But this was before the revision of it by Brady and Norman had appeared. Those authors had the opportunity of examining a female specimen 7 mm. long, taken by the Porcupine Expedition of 1869, in the Atlantic, west of Donegal Bay, Ireland, lat. 55° 11′ N., long. 11° 31′ W., in which the genus was originally founded was a male, 84 mm. in length, taken by the Challenger from a reputed depth of 1100 fathoms, bottom temperature 35°.6 Fahr., a little to the East of New Zealand, lat. 40° 28′ S., long. 177° 43′ E. That the two specimens belong to the same genus cannot reasonably be doubted, and, notwithstanding the enormous interval between the places of capture, Brady and Norman assign them to the same species, *Crossophorus imperator*. That they are very nearly allied may be readily allowed, but their specific identity is not so clear. The Irish specimen appears to have the antennal notch more widely open but considerably less deep than it is in the shell from the Pacific. In the figure of the latter it penetrates back decidedly beyond the middle of the valves toward the dorsal margin, while in the former it scarcely reaches the middle. Distally on its front margin the mandible has a row of 12 setæ in the Pacific specimen, but only 6 in that from the Atlantic. The little apical lobe of the maxillipeds is well marked in the Pacific specimen, but much less distinct in the other. The vermiform appendage of the male is described as almost exactly like that of *Cypridina*, whereas in the female "at the extremity one lip is in

the form of a blunt tooth; the other is divided into several (six?) finger-like curved processes, which are ciliated on the edges." In the caudal laminæ the stout ungues are seven in number in the female specimen, but in the male they seem to be certainly less numerous, though here, unfortunately, we have to judge not from the spines themselves, but from the scars of their places of insertion. The differences mentioned have led me to give the Irish specimen a distinctive name, *Crossophorus imperialis*.

In discussing the large lamina in the maxillipeds of *Cypridina*, G. W. Müller suggests that it represents the coalescence of two joints, and to this view the apical lobe of the lamina in *Crossophorus* lends probability.

## Crossophorus africanus, Stebbing.

### Plates 15a and 16.

1901. *Crosophorus africanus*, Stebbing, Knowledge, vol. 24, p. 100.

Shell smooth, not very hard, surface diversified by oily-looking little circles; antennal notch not widely opened, reaching to the middle of the valve, the subacute rostral process finely ciliated on its lower margin.

Of eyes, median ocellus, or frontal tentacle, I have not found any trace, nor is mention of them made under this genus by Brady or by Brady and Norman. The first antennæ have the first joint long and broad, the second narrower and not quite so long, but longer than all the remaining joints together, more than twice as long as the third, which is obliquely articulated with the much shorter fourth; the fifth has an annulated sensory seta, carrying on one side a double series of branchlets, followed after a considerable interval by some very small ones at the distal end; on the two little terminal joints there are seven, mostly very unequal, setæ, three of them very long. Brady and Norman include in their character of the genus antennules with second joint only slightly longer than the third, but their figure shows it considerably longer than the third and fourth joints combined.

The second antennæ have the swimming branch divided between the long apically widened first joint and the eight following joints, of which the first is considerably the longest, the first seven each armed with one plumose seta attended by a short spine, the terminal having seven such setæ; the secondary appendage in the female is straight, its middle joint the longest, the third tapering.

The mandibles have the strongly hirsute and sharply two-pointed masticatory process projecting from distal part of first joint, with several spines adjoining on base of second, from inner margin of which issues a long plumose seta, the outer margin

carrying about nine spines below the apex, and at the apex the small pointed exopod; the third joint is short, with two plumose setæ and three or four simple setæ on the inner margin; the fourth joint is long, thickly set with spines along much of the outer and at the apex of the inner margin; the short fifth joint carries two long ungues and some straight spines.

The first maxillæ have a rather broad inner plate surmounted by numerous plumose spines or setæ; within this is another plate which carries a long plumose seta on the inner margin, then narrows to a rounded apex set with numerous spines; close by the side of it is another plate, hairy on the inner margin, and distally carrying three setæ; on the outer side is the longest and broadest part of the maxilla, carrying three slender spines on a projection of its outer margin near the base and a group at the apex, with which is articulated a short terminal joint armed with several spines, some of them denticulate.

The second maxillæ have at least a hundred plumose setæ fringing the great vibratory lamina; close to the apex of this is a small plate carrying two setæ, then a two-jointed plate with numerous slender spines, and to this succeeds a series of five lobes variously armed, the first three having each a set of graduated spines so closely placed that from one view the largest hides all the rest; on the lowest lobe there is a bunch of feathered spines.

The maxillipeds have on the lowest lobe three plumose setæ, and several shorter plumose setæ or spines on the apices of the next three lobes; the large sub-triangular lamina has its convex outer margin fringed with numerous spines and long plumose setæ, of the latter the little apical lobe carrying thirteen, the six nearer the notch considerably shorter than the distal seven.

The vermiform appendage has a head-like apex, wider than the trunk, with a brush of terminally denticulate spines on each side; the mouth is formed by a rather strong tooth over a denticulate margin, confronting what may be called the upper jaw, which consists of a circlet of fine denticles; the annulated trunk is armed far along with at least a hundred and fifty denticulate spines.

The caudal laminæ have twenty-five ungues a-piece, more or less conspicuously dentate; the largest of all is on the apex, a rather slighter one being planted close behind this a little on the ventral margin; the apical unguis is followed by two much more slender ungues, then by two similar trios on a smaller scale, and finally by a stout unguis heading a procession of fourteen small graduated spines. In advance of the furca the margin is downy for a space, and the strongly-bent part of the dorsum is transversely corrugated, the narrowness of the numerous folds or stripes producing an annulated appearance.

As already noticed the shell surface of the preserved specimens does not present an uniform texture The opaque ground is everywhere beset with glossy circles in great numbers, of very different sizes, though none of them are

large. Within the valves of a dissected specimen there were found in corresponding variety crystals, singly or in laminar groups, examples of which are figured on plate 15A. Professor S. H. Vines, F.R.S., President of the Linnean Society, having kindly undertaken to examine the shell and some of the detached crystals, writes :—

"As far as I can make out, these sphæro-crystals are not soluble in boiling water, but dissolve in acetic acid with evolution of bubbles of gas which is no doubt carbon dioxide.

"The examination of the piece of carapace seems to show that, for some reason or other, the carbonate of lime has crystallised out from the chitin. The crystals from the inside of the carapace are, I am inclined to think, some of the sphæro-crystals of carbonate of lime which have got free from the carapace altogether.

"I think that this separation of the lime from the chitin must be due to the action of the preservative in which the animals have been kept, though I am unable to account for it."

In the Trans. Zool. Soc. London, vol. 16, part 4, April, 1902, Dr. G. S. Brady, F.R.S., says in regard to *Cyclasterope fascigera*, n. sp., "The antennal setae of this species are often much encumbered, or even glued together by crystalline calcareous concretions similar to those which I have already described and figured as occurring in *Philomedes sculpta*." The latter species was described by Dr. Brady in the same Transactions, vol. 14, part 8, December, 1898. Dr. Brady, after discussing the nature of the concretions is disposed "to look upon them as pathological products which have withdrawn the lime otherwise available for shell-formation."

Mr. W. A. Cunnington, writing from Jena, states that in his study of the common Cladoceran *Simocephalus* he happens "to have noticed that the shed shell (or Ecdysis) is always accompanied by a large number of minute crystals," and asks, "might it be that the calcareous salts in the shell are temporarily *dissolved* to facilitate ecdysis, and the mineral matter is then thrown down in the presence of the excess of water?"

That there is some connexion between the presence of the detached crystals and the animal's preparation for changing its coat, seems highly probable. But the Ostracoda must be able to shed the carapace with great ease, and the adhesive character of the crystals under discussion would be so inconvenient to the living crustaceans that it will be satisfactory if the observed conditions can be definitely attributed to the action of the preservative fluid.

Size:—The largest specimen was 15·5 mm. long by 13 mm. in height, or what may be called the breadth in a lateral view.

Another specimen measures 15 mm. by 11.25 mm. The smallest specimen was 11·25 mm. by 8·75 mm., and in this there was a young one measuring 2.4 mm. by 1.66 mm. All the specimens appeared to be females.

The young one just mentioned exhibited the various appendages in a forward condition of development, with the exception of the vermiform limb, the presence or absence of which was not ascertained. The second antennæ have a single simple seta attended by a spine on the apical joint, and each of the preceding joints similarly armed. The secondary appendage is indistinctly jointed, and has a long apical seta. The antennal notch is set far back, instead of being forward as in the adult; the ventral margins of the valves are wide apart, and dorsally the valves are open anteriorly, showing bases of the two pairs of antennæ. A much less advanced embryo from the largest specimen shows the same backward position of the antennal notch, but the valves more nearly meeting in front. By comparison of these two examples, it may be supposed that the body at a certain stage develops more rapidly than the valves.

Locality:—Cape St. Blaize N. by E. 73 miles. Depth, 125 fathoms. Bottom, sand and shells. And, Cape St. Blaize N. by E. 67 miles. Depth, 90-100 fathoms. Bottom, rough.

Professor Chun, in his account of the Valdivia expedition, figures some giant Ostracoda from depths of the Atlantic and Indian Oceans. Some of the specimens were taken off the East African coast, but they do not agree in shape with the species above described, and are assigned to the family Halocypridæ (see Aus den Tiefen des Weltmeeres, p. 515, figures in text, 1900).

## ADDENDA ET CORRIGENDA IN "SOUTH AFRICAN CRUSTACEA," PART I., 1900.

On p. 30 in the reference to "*Linuparis*, White, 1847," the generic name should be *Linuparus*. Attention was called to this by Dr. Woodward in the Geological Magazine, vol. 7, p. 394, where, however, the error is not traced back to its source in the report on the Challenger Macrura.

P. 33. To the list of those who have used *Astacus* as the generic name of the lobster may be added Westwood, in the Entomologist's Text-book, p. 101, 1836.

P. 37. In the last line the epithet "perplexing" is quite inappropriate to the statement quoted from Huxley, and the comment upon it with which the paragraph ends on p. 38 is quite beside the purpose. The mistake arose from a confusion of the eighth somite of the body with what is sometimes called the eighth thoracic somite. As my friend Dr. W. T. Calman promptly pointed out, there is only an infinitesimal difference between Huxley's observation that the second maxilliped in the lobster is without an arthrobranchia, and the explanation by Boas that this arthrobranchia is reduced to a pimple.

P. 49. In the synonymy of *AEgeon* should have been included a reference to Faxon's Stalk-eyed Crustacea of the Albatross, Mem. Mus Comp. Zoöl Harvard, vol. 18, 1895, where an important footnote to p. 134 discusses that genus (with the changed spelling *AEgaeon*), and expresses the opinion that Bate's *Pontocaris* is to be identified with it.

Pp. 54, 55. Some modifications in the description of the first maxillæ and maxillipeds of *Paridotea ungulata* are supplied in the account now given of the family *Idoteidae*.

P. 60. It should have been mentioned that the specimen of *Sphyrion laevigatum* was taken from a *Genypterus capensis*, locally known as the "King-Klipfish."

## EXPLANATION OF PLATES.

*The plates are numbered consecutively to those of "South African Crustacea," Part I.)*

### PLATE 5.

PLATYMAIA TURBYNEI, n. sp

A. n.s. Dorsal view of a specimen, natural size. Fourth trunk-limb missing on the right side, and two terminal joints of the third limb on the left.

B. oc., a.s , a.i., pal. Underside of head of another specimen showing eyes, first and second antennæ, epistome, and part of palatal floor. Magnified.

B. car. Carapace of second specimen in lateral view, left side a little raised, natural size.

B. Pl. Sternal plastron and pleon of the second specimen, natural size.

### PLATE 6.

SCYRAMATHIA HERTWIGI, Doflein.

Dorsal view of a male specimen, life size, without the right cheliped and three following feet.

C.V. Cephalon in ventral view, showing the two pairs of antennæ and one member of the third maxillipeds in situ, natural size.

Pl. Dorsal view of pleon, natural size.

a.s. First antenna.

m. Mandible.

mx. 1, mx. 2. First and second maxillæ.

mxp. 1, 2, 3. First, second, and third maxillipeds.

Ch. Right cheliped, natural size.

The separate figures of first antenna and mouth organs are magnified two diameters.

### PLATE 7.

JASUS PARKERI, n. sp.

Dorsal view of specimen, natural size, with second antennæ truncated not far above the peduncles,

## Plate 8.

### Callianassa rotundicaudata, n. sp.

n.s. Natural size of specimen, lateral view; beneath it is a dorsal view of the same specimen magnified two diameters.

a.s., a.i. First antenna, with basal joint covered by the eye; peduncle of the second antenna.

m. Mandible.

l.i. Lower lip.

mx. 1, mx. 2. First and second maxillæ.

mxp. 1, 2, 3. First, second, and third maxillipeds.

prp. 1-5. First to fifth peræopods. The larger cheliped from the right side of the specimen is on the left side of the plate, with the outer surface shown. The smaller companion cheliped is on the right side of the plate.

plp. A pleopod.

plp. r. Retinaculum of the pleopod greatly magnified, with one of the marginal setæ.

T., urp. Telson and uropods attached to their segment.

The detached antennæ and limbs of peræon and pleon are all magnified to the same scale. The mouth organs are magnified to a scale double of the preceding.

## Plate 9.

### Cirolana venusticauda, n.sp.

n.s. Natural size of the specimen which is shown in dorsal view.

T., urp. Dorsal view more highly magnified, from another specimen, extending from sixth segment of peræon to end of telsonic segment and the uropods.

Pl. L. Lateral view of pleon.

a.s., a.i. First and second antennæ; distal joints of first more highly magnified.

l.s. Upper lip, with epistome and frontal lamina.

m. Mandible from the inner (upper) side; with the cutting edge, accessory plate, and equivalent of molar, more highly magnified.

mx 1, mx. 2, mxp. First and second maxillæ and maxilliped; with spines and setæ of first maxilla more highly magnified.

gn. 1, gn. 2. First and second gnathopods.

prp. 4. Fourth peræopod.

The mouth organs are magnified to a higher scale than the other appendages.

## Plate 10.

### Glyptidotea lichtensteinii (Krauss).

n.s. Line showing natural size (length) of specimen figured at the top of the plate in dorsal view.

a.s., a.i. First and second antennæ, with flagellum of first more highly magnified.

l.s. Upper lip, surmounted by the epistome.

g. Part of stomach, showing the cardiac folds above and the ventral fold below.

m.m. Mandibles, viewed from the inner side: with cutting plates, spine-row, and molar, more highly magnified.

mx. 1., mx. 2. First and second maxillæ; with spines of the first more highly magnified, as seen from the outer and inner sides.

mxp. One of the maxillipeds.

gn. 1, gn. 2, prp. 5. First and second gnathopods and fifth peræopod. A grasping spine and one of the surface spines of the first gnathopod more highly magnified.

urp. One of the uropods.

Whole specimen enlarged two diameters; antennæ, limbs, and uropod drawn under three-inch objective, mouth organs under two-inch, and more magnified details under one-inch.

## Plate 11.

### Exosphaeroma amplifrons, n. sp.

n.s. Natural size of specimen, of which lateral view is given.

C. Head seen from front, with epistome flanked by basal joint of first antennæ, and mandibles showing below.

Pl. Dorsal view of pleon.

or. p. Oris partes, ventral view of mouth-parts in position, flanked by lateral parts of head and first peræon-segment.

a.s., a.i. First and second antennæ; the first seen from outer side.

l.s. Upper lip, surmounted by epistome attached to part of head.

l.i. Lower lip.

m.m. Mandibles from inner surface.

mx. 1. First maxilla.

mxp. Maxillipeds.

gn. 1. First gnathoped.

prp. 5. Fifth peræopod.

## Plate 12a.

### Exosphaeroma validum, n. sp.

n.s. Natural size of specimen represented in the adjoining figure, nearly full dorsal view.

C. Pr. s. 1. Front view of head and first peræon segment. The first antennæ, epistome, upper lip, and mandibles are shown in situ.

a.s., a.i. First and second antennæ; the first seen from inner side.

l.s., l.i. Upper lip and epistome in attachment to margin of head, and lower lip.

mxp. Maxillipeds.

gn. 1. First gnathopod.

## Plate 12b.

### Exosphaeroma setulosum, n. sp.

n.s. Length of specimen in partially bent position, as shown in lateral view.

C. Front view of head, with basal joint of first antennæ in situ.

Pl. Dorsal view of pleon.

a.s., a.i. First and second antennæ; the first seen from inner side.

l.s. Upper lip and epistome.

mxp. Maxillipeds.

## Plate 13.

### Parasphaeroma prominens, n. g. et sp.

n.s. Natural size of specimen in dorsal view at top of plate.

a.s., a.i. First and second antennæ.

ep., l.s. Epistome and upper lip.

mx. 1, mx. 2. First and second maxillæ.

mxp. Maxilliped.

gn. 1, gn. 2. First and second gnathopods.

prp. 1, 5. First and fifth peræopods.

plp. 2, 5. Second and fifth pleopods.

The separate appendages magnified to the same scale, about twelve and a half diameters.

## Plate 14.

### Cymodoce uncinata, n. sp.

n.s. Natural size of specimen in lateral view at top of plate.

Pl. D. Dorsal view of pleon, magnified three diameters.
Pl. L. Lateral view of pleon, much more magnified.
a.s., a.i. First and second antennæ.
ep., l.s. Epistome and upper lip.
mx. 1, mx. 2. First and second maxillæ.
mxp. Maxilliped.
gn. 1. First gnathopod.
prp. 5. Fifth peræopod.
pen. Male organs from seventh segment of peræon.
plp. 2, 3, 5. Second, third, and fifth pleopods.
The separate appendages all drawn to the same scale, magnified about twelve and a half diameters.

## Plate 15A.

### Crossophorus africanus.

app. v. and c. l. Hind portion of a specimen with eggs, in lateral view, showing the vermiform appendage directed upward, the caudal lamina pointing downward, and above this on the right the two genital tubercles.

ov. 1. Large egg, in lateral and dorsal view, from small specimen.

a.i. Second antenna from the large egg.

ov. 2. Egg from a large specimen which was infested with well-developed female and larvæ of *Cyproniscus*.

cr. Crystals forming flattened layers within the valves of a large ovigerous female; many of the crystals carrying setules and plumose setæ evidently stripped from the organs of the Ostracode.

All the above are much magnified representations.

## Plate 15B.

### Cyproniscus crossophori.

n.s. Natural size of the larva, figured in dorsal view at the middle of the plate, and also natural size of the developed female, figured on the left hand below, much less highly magnified, with a larva beside it to the same scale.

C.V. Cephalon of larva in ventral view.

a.s., a.i. First and second antennæ.

gn. 2. Second gnathopod, in attachment to its segment, with ventral view of first segment and part of third.

prp. 5. Fifth peræopod.

plp. 1. First pleopod.

T. urp. Telsonic segment in dorsal view, with the uropods.

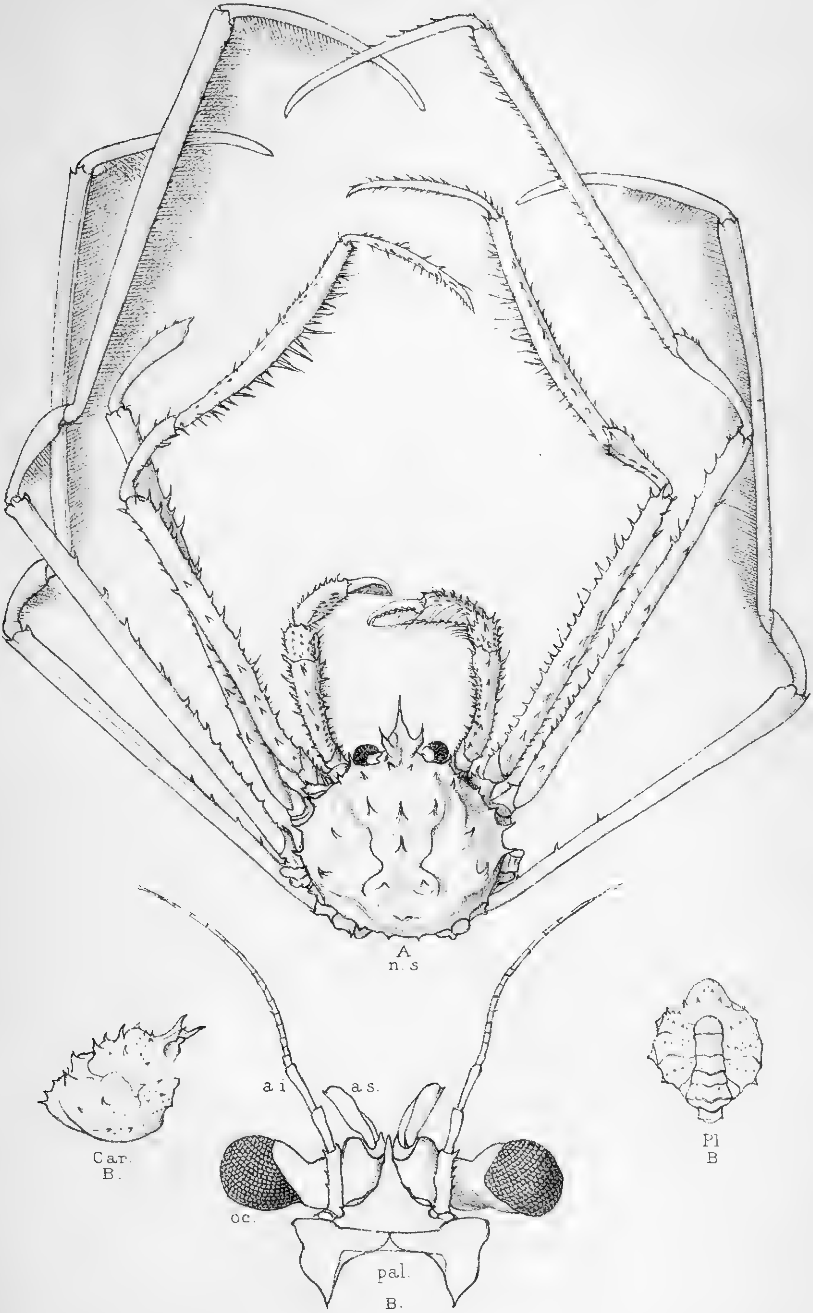
## Plate 16.

### Crossophorus africanus.

n.s. Natural size of a specimen, left side.
a.s., a.i. First and second antennæ.
m. Mandible.
mx. 1. mx. 2. First and second maxillæ.
mxp. Maxilliped.
app. v. Vermiform appendage.
c.l. Caudal lamina.

# INDEX.

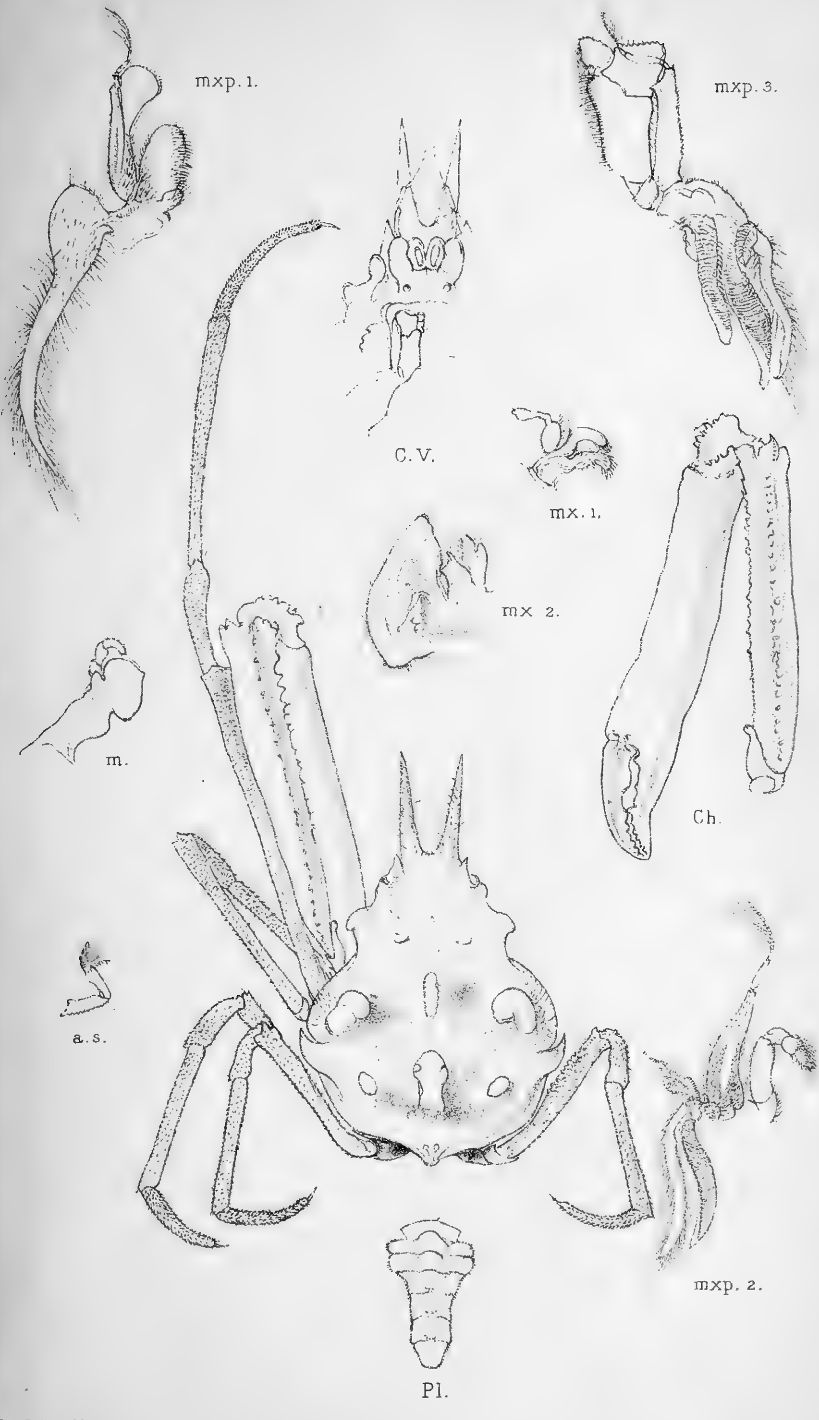
[PUBLISHED 7th OCTOBER, 1902.]




del. T. R. R. Stebbing.

J.T. Rennie Reid, Lith. Edin^r

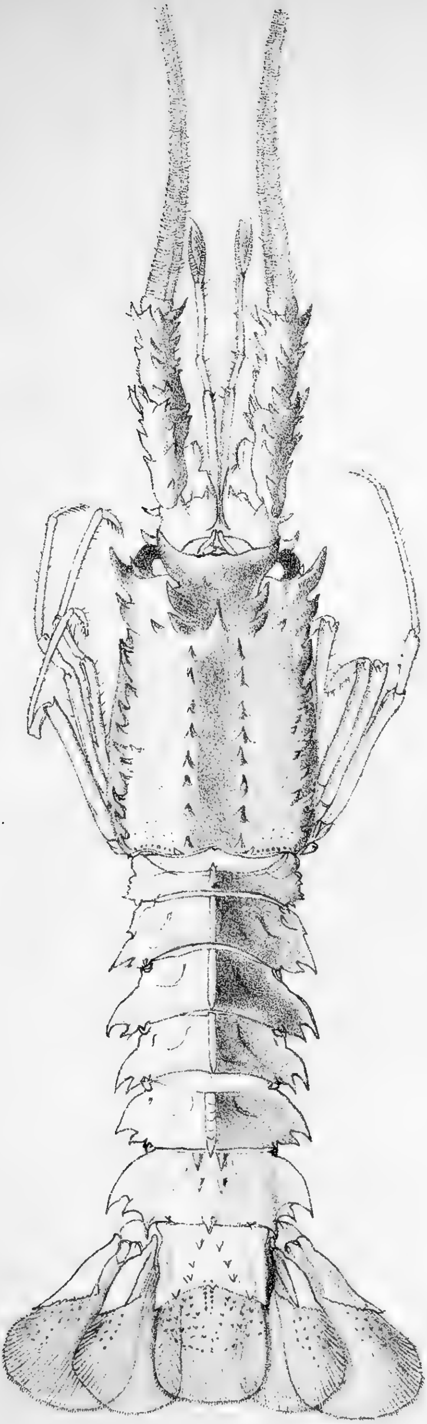
PLATYMAIA TURBYNEI, n. sp.




Del. T. R. R. Stebbing.

J. T. Rennie Reid, Lith. Edinr

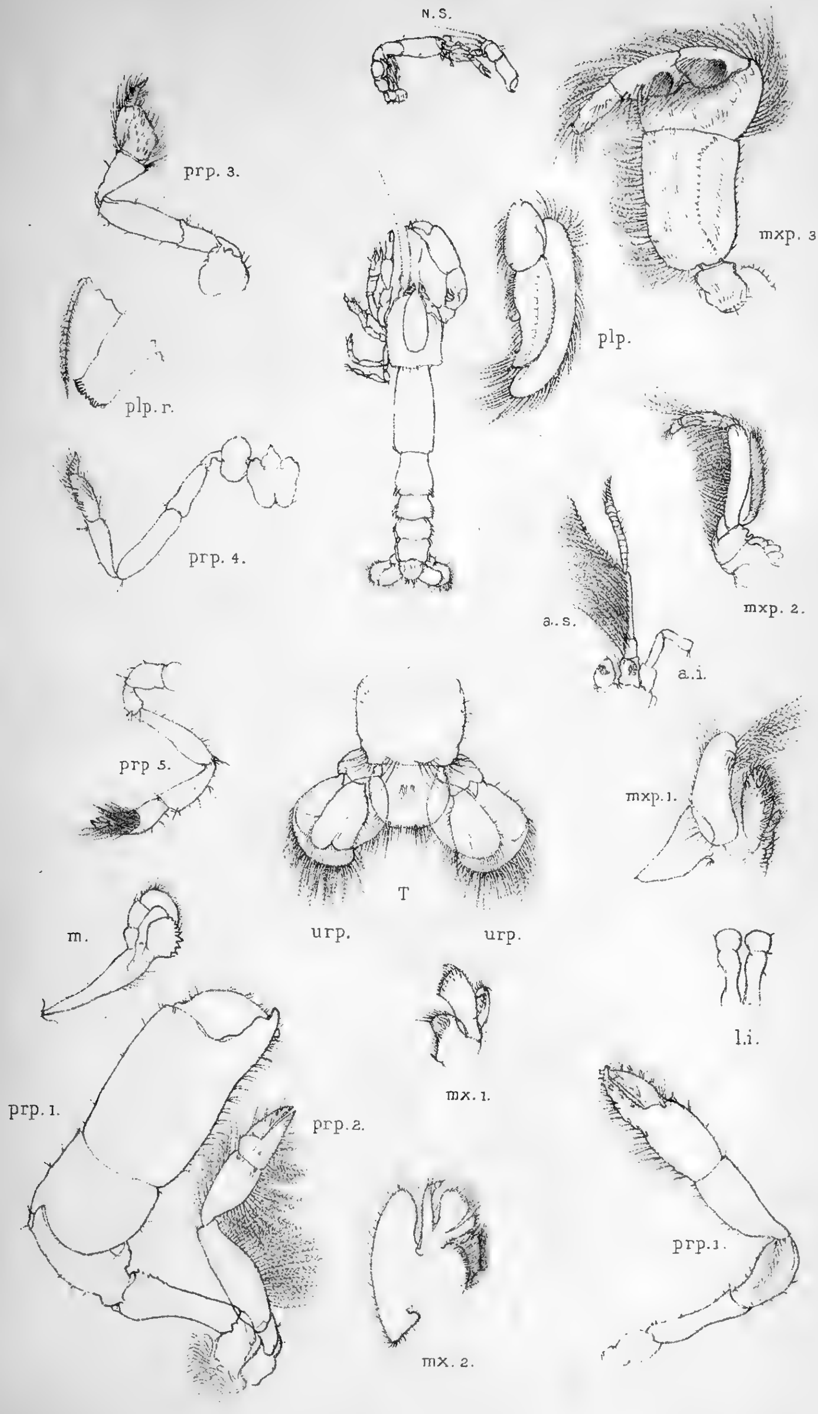
SCYRAMATHIA HERTWIGI, Doflein.



Del. T. R. R. Stebbing.

J. T. Rennie Reid, Lith. Edin.r

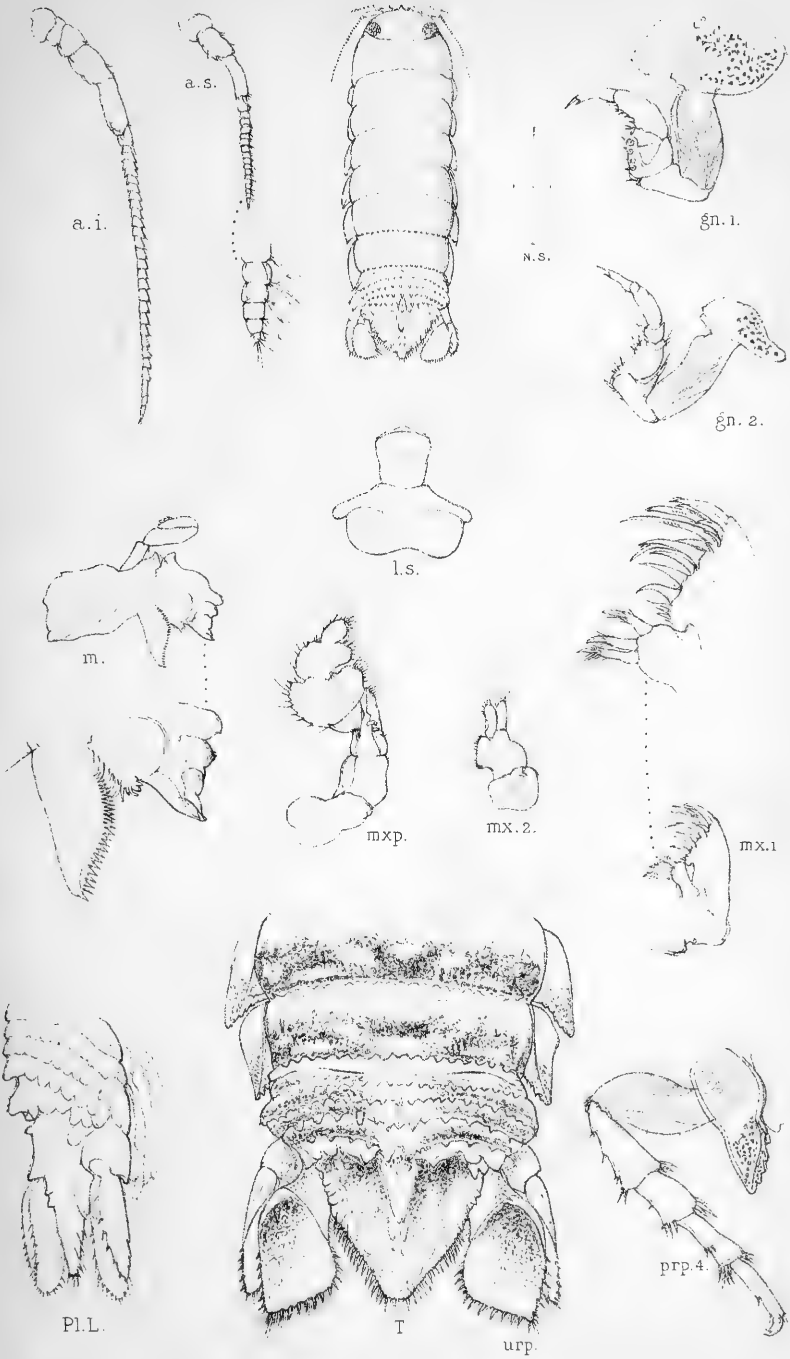
JASUS PARKERI, n. sp.




Del. T. R. R. Stebbing.

J. T. Rennie Reid, Lith. Edin.

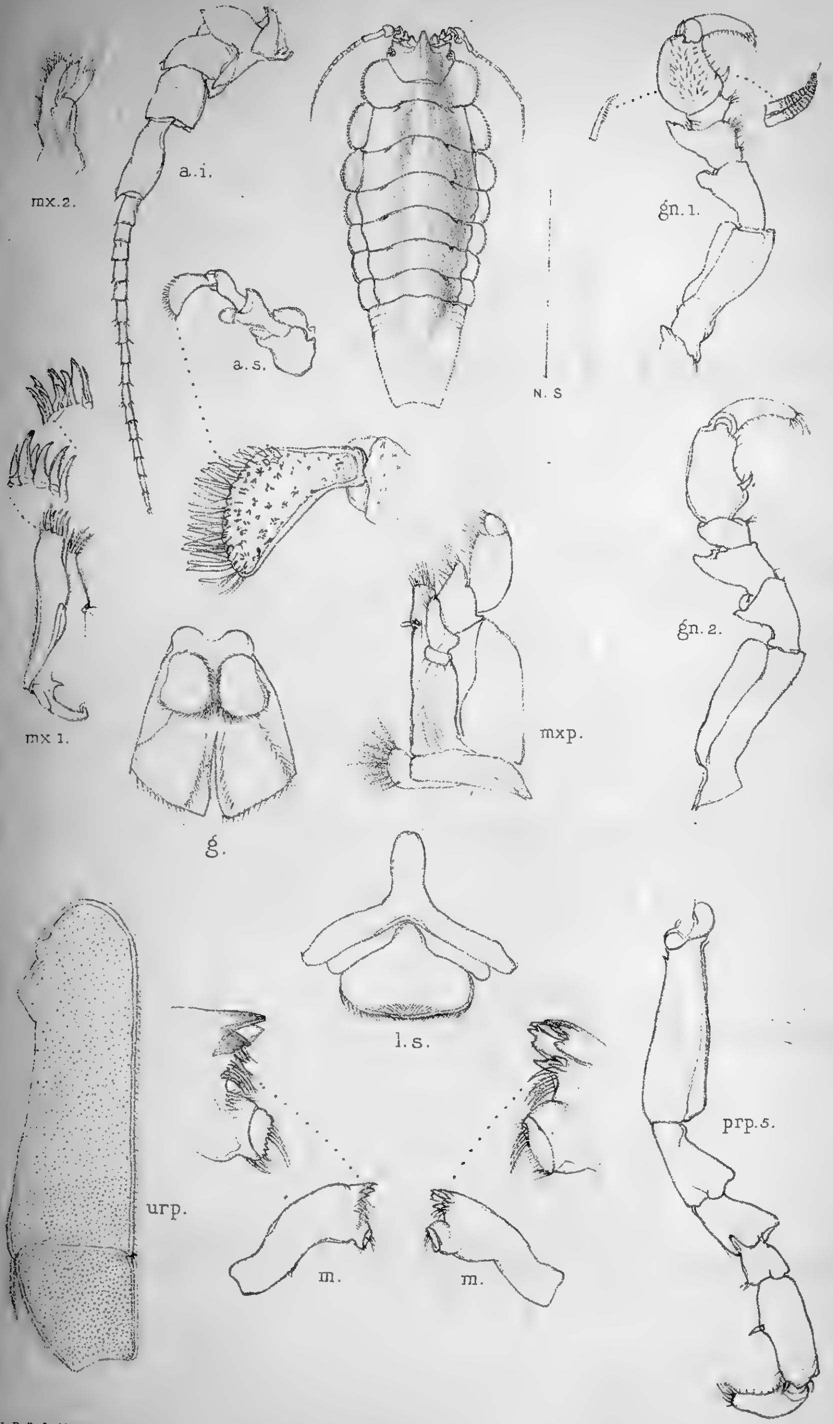
CALLIANASSA ROTUNDICAUDATA, n. sp.




Del. T. R. R. Stebbing.

J. T. Rennie Reid, Lith. Edin.

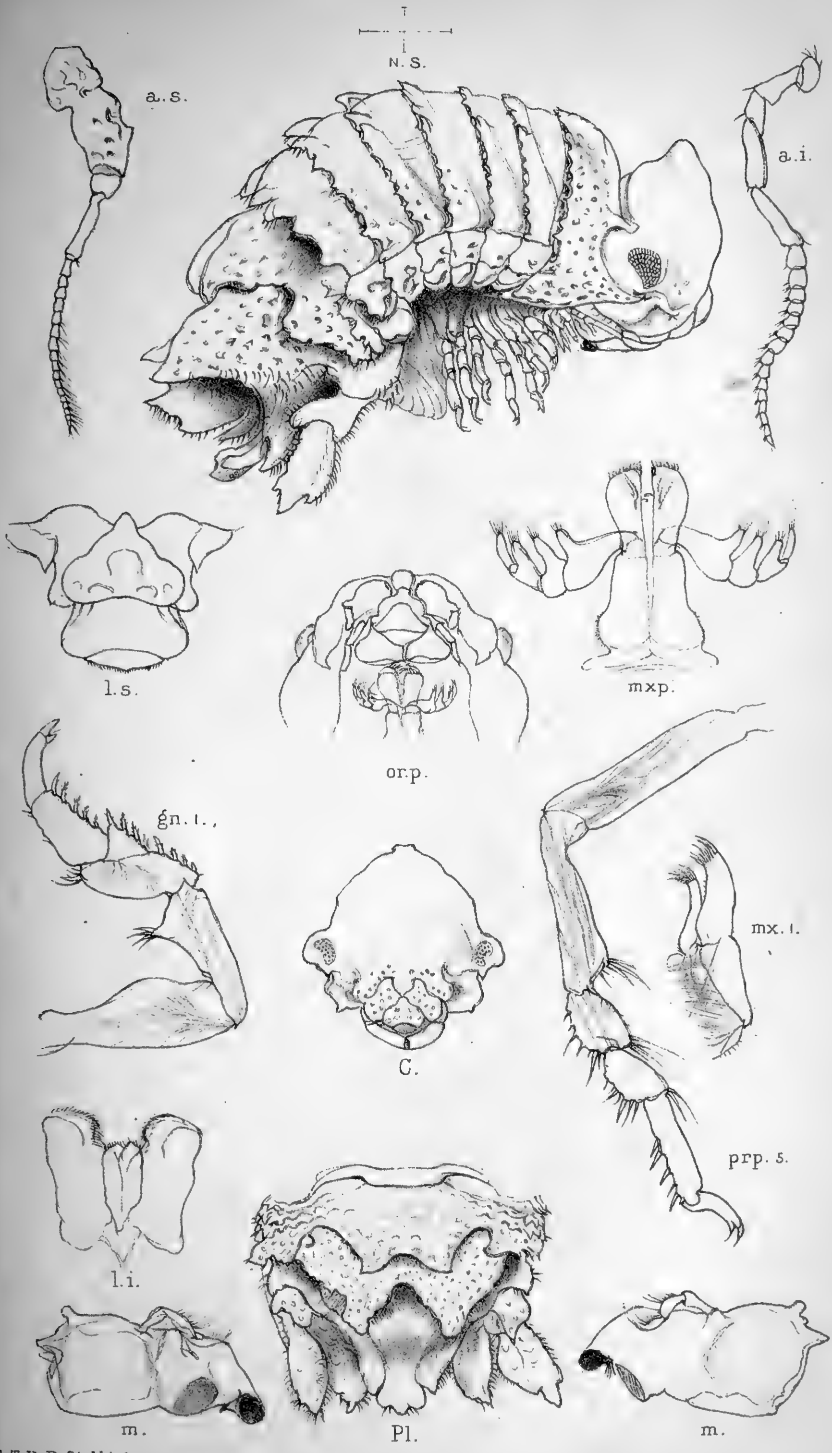
CIROLANA VENUSTICAUDA, n. sp




De. T. R. R. Stebbing.

J.T. Rennie Reid, Lith. Edinr

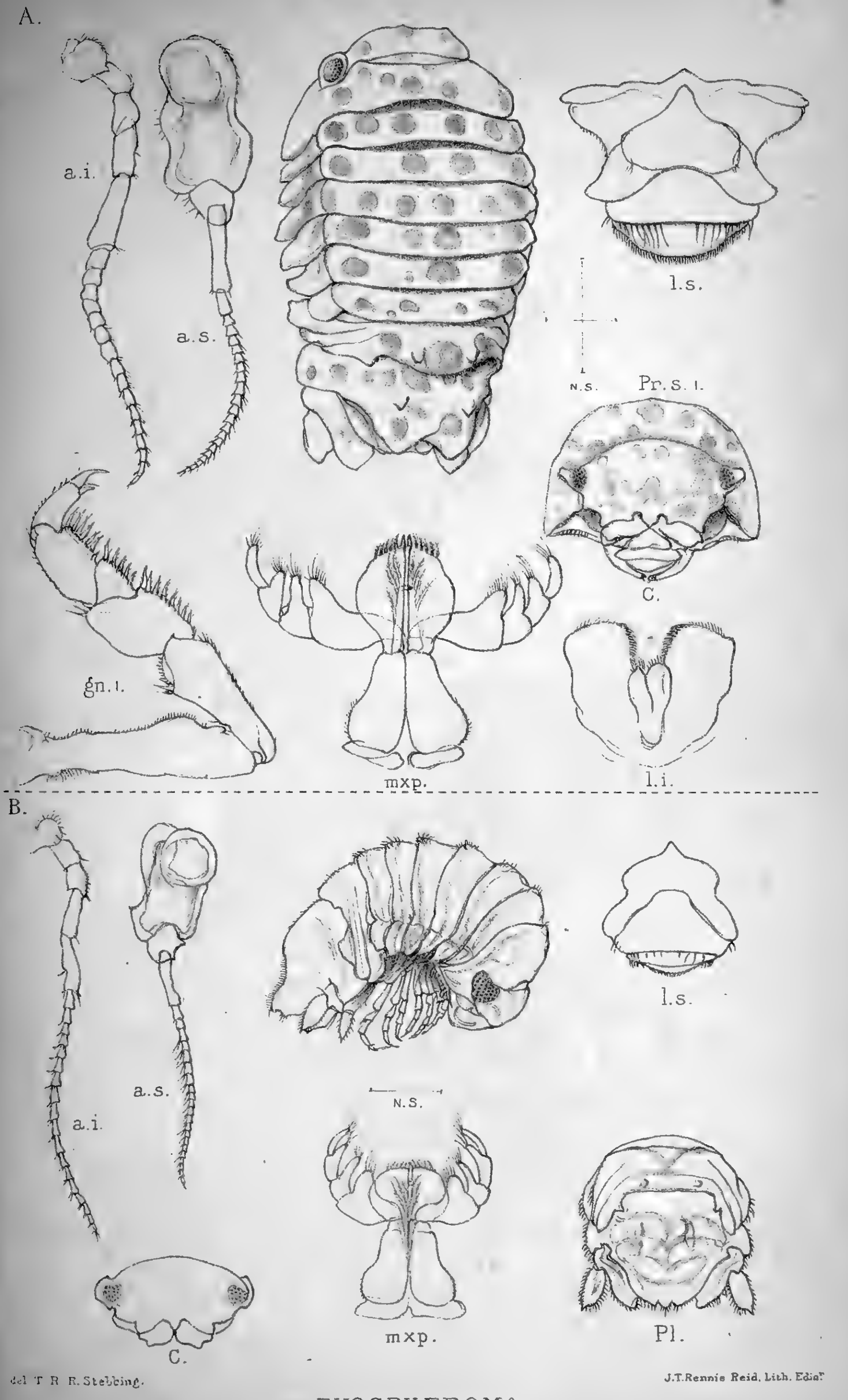
GLYPTIDOTEA LICHTENSTEINII (Krauss)




del. T. R. R. Stebbing.

J. T. Rennie Reid, Lith. Edinr.

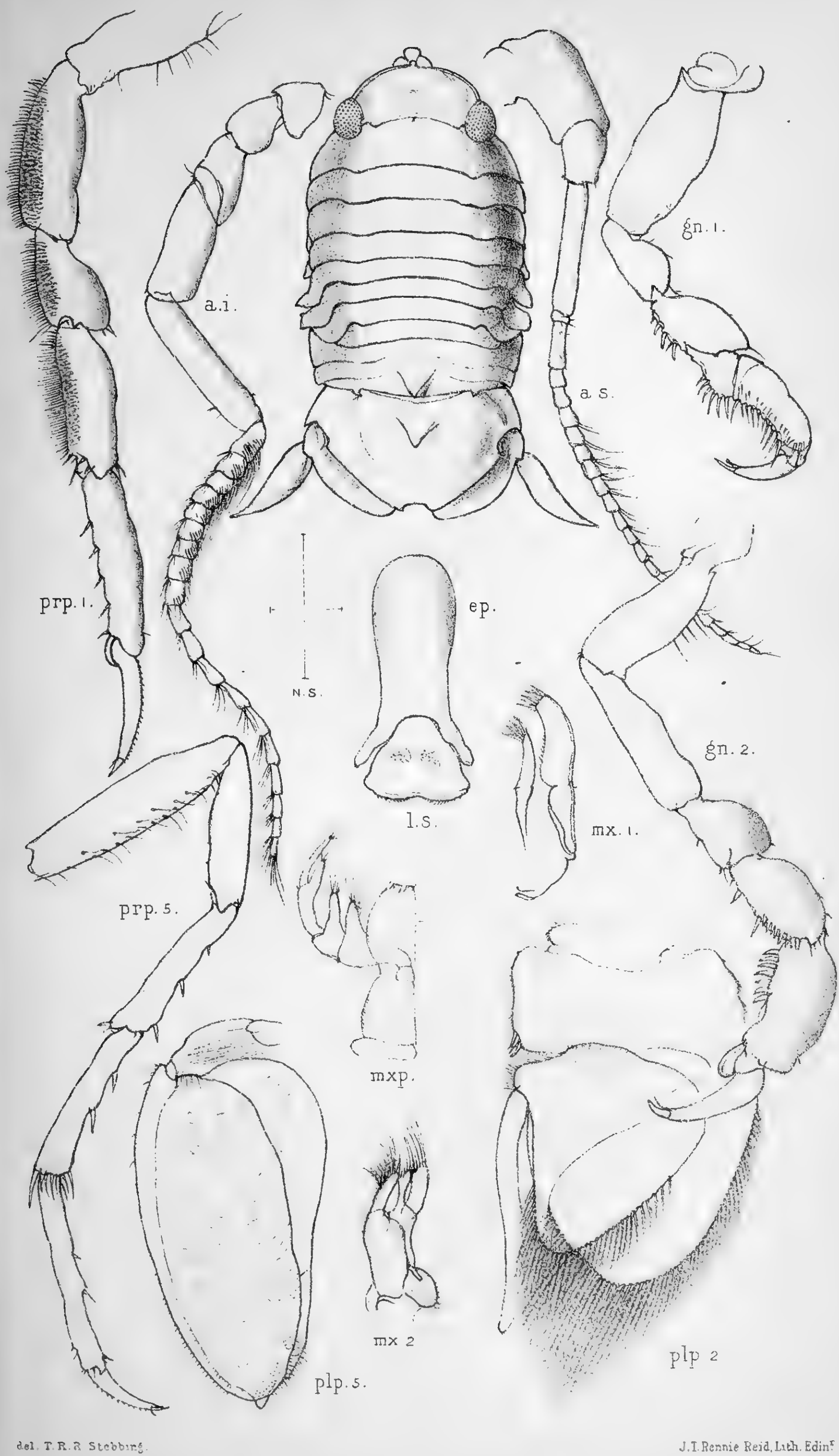
EXOSPHÆROMA AMPLIFRONS, n.sp.




del T R R Stebbing. J.T. Rennie Reid, Lith. Edin.

EXOSPHÆROMA

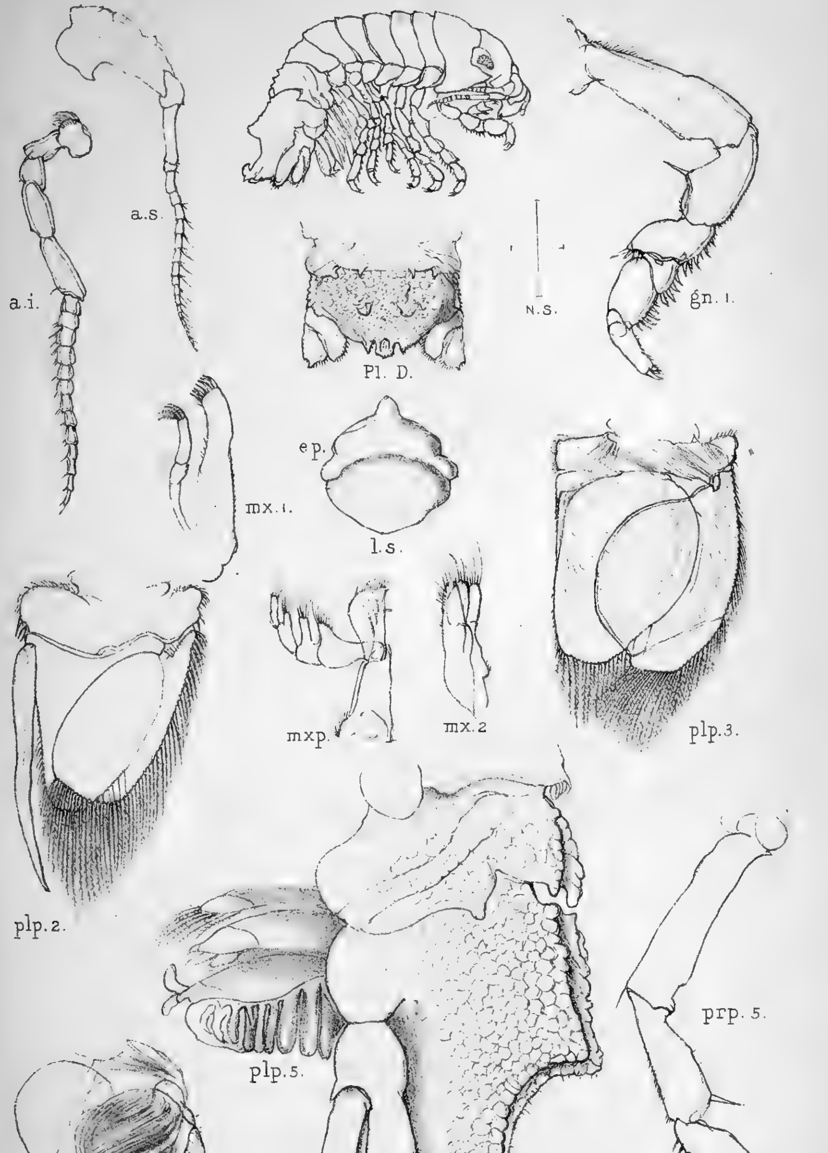
(A). VALIDUM, n.sp. (B). SETULOSUM, n.sp.




del. T. R. R. Stebbing.

J. T. Rennie Reid, Lith. Edinr.

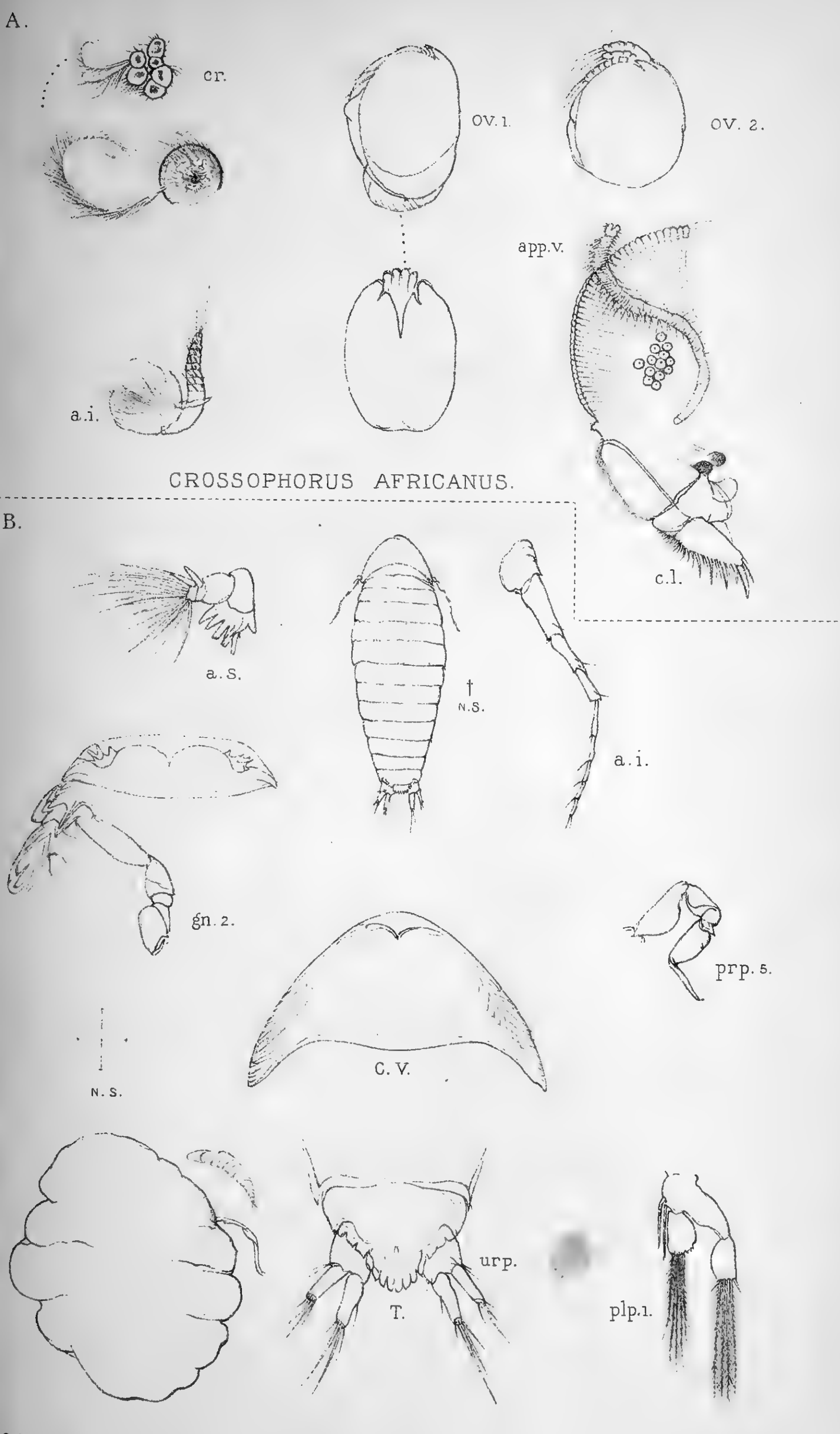
PARASPHÆROMA PROMINENS, n. g. et sp.




del. T. R. R. Stebbing.

J. T. Rennie Reid, Lith. Edinr.

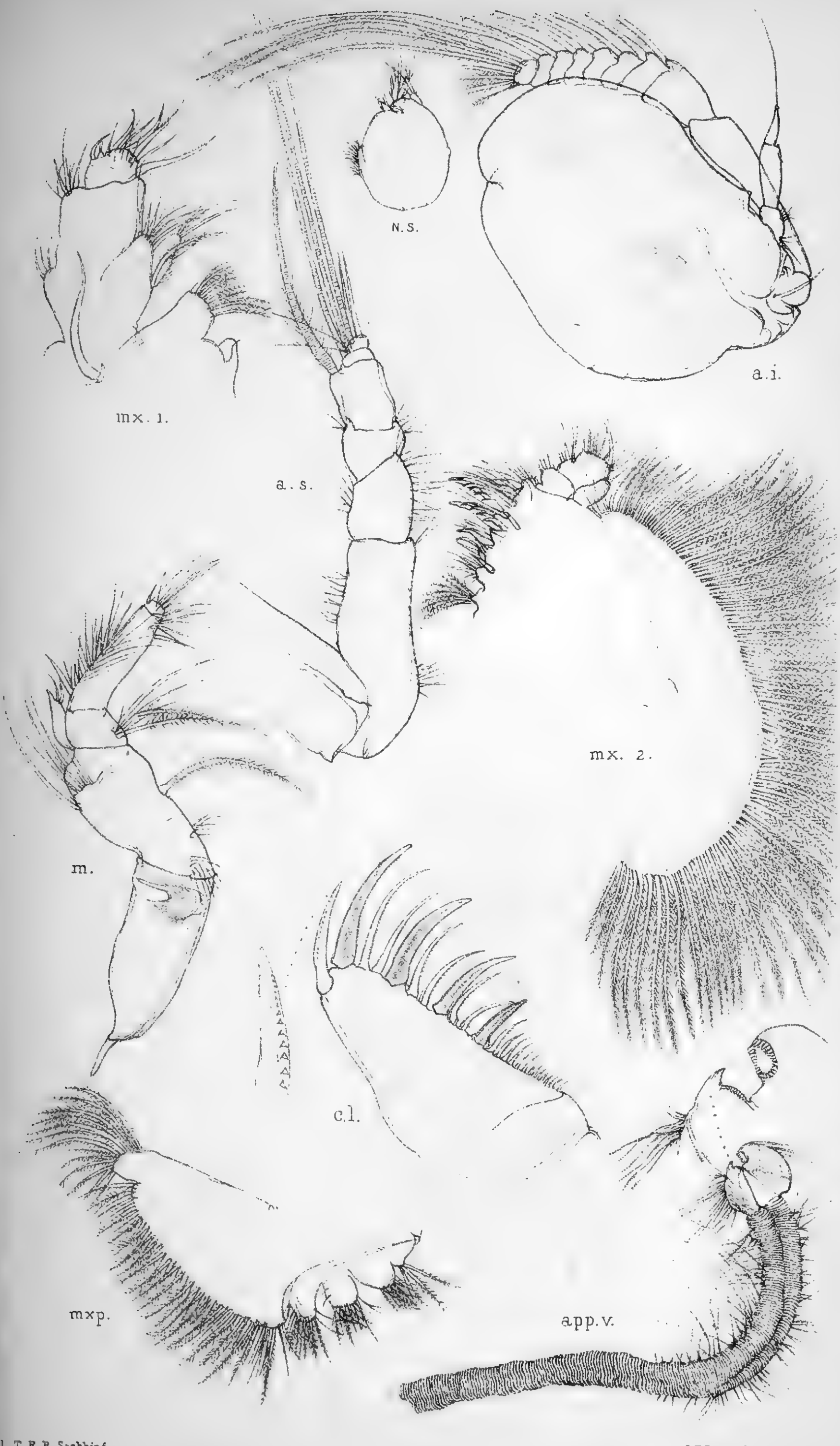
CYMODOCE UNCINATA, n. sp.




Del. T. R. R. Stebbing

J. T. Rennie Reid, Lith. Edinr.

CYPRONISCUS CROSSOPHORI, Stebbing.




Del. T. R. R. Stebbing.

J.T.Rennie Reid, Lith. Edinr.

CROSSOPHORUS AFRICANUS, Stebbing.

# MOLLUSCA OF SOUTH AFRICA,

BY

G. B. SOWERBY, F.L.S.

Since the publication of my description of the remarkable *Neptuneopsis Gilchristi* in "Marine Investigations," 1898, several small lots of mollusca have been sent to me, as the results of more recent dredgings, for identification and description. A considerable proportion of these belong to well known species, some of which, however, having now been taken for the first time alive, are worthy of special notice, particularly the *Volutilithes abyssicola,* and the *Eburna papillaris.* In this paper, while making mention of, and some notes on the known species, I am describing six which I believe to be new to science—notably, a new *Volutilithes,* making the third recent species of the genus. Of this, unfortunately, only dead shells have as yet been procured, but, having been dredged in deep water at a somewhat greater depth than *V. abyssicola,* it is quite probable that it may still exist in a living state.

EBURNA PAPILLARIS, Sowerby (Plate II., fig 3). Tank. Cat. app. 22., Thes. Conch. vol. iii., p. 70, pl. 215, fig. 7.

One specimen only, procured by dredge at Algoa Bay. Lat., 32° 50′ S.; long., 25° 54′ 30″ E. Depth, 24 fms. Bottom, sand, shells, and rock.

With regard to the shell, there is little to add to the original description, but the markings are somewhat different, consisting of transversely oblong, not rounded, spots. The periostracum is exceedingly thin and transparent, scarcely obscuring the pattern of the shell. This may possibly not be always the case in the species, as the Eburnæ, like other Buccinoids, present considerable variation in the character and thickness of the periostracum covering different shells of the same species; for instance, I have before me an *Eburna canaliculata* with a thick, dark brown, scabrous coat entirely hiding the pattern of the shell, and another with a light yellowish covering which is perfectly transparent, a light veil which does not in the least mar the beauty of the pattern beneath. On the other hand, *E. zeylanica* appears to have invariably a very light covering.

The specimen of *Eburna papillaris* has the body well distended, revealing its form as in life. It is beautifully marbled with red spots similar in form to those which adorn the shell. The foot is broad and high, rounded in front with a double margin, tapering posteriorly, and terminating in a curious little tail-like projection. The head is small and flat; tentacles rather short and tapering; eyes at the outer base of the tentacles on slight prominences; proboscis rather long and inflated; siphon rather short and thin.

NASSA EUSULCATA, n. sp. (Plate II. fig. 8). Shell pale straw colour tinged with light brown; spire rather long, sharply acuminated; whorls nine, the first two smooth and rounded, the rest moderately convex, longitudinally ribbed and spirally grooved; ribs rendered slightly nodulous by the intersecting sulci, and narrower than the interstices; grooves rather deep (5 on the penultimate, and about 16 on the last whorl), the one next to the suture being broader and deeper than the others, dividing the tops of the longitudinal ribs; suture slightly channelled. Last whorl rather more than half the entire length of the shell, slightly inflated, contracted at the base. Aperture moderately wide, narrowing posteriorly into a shallow canal; anterior canal short, rather wide; columella covered with a rather thin projecting callus, roughly and irregularly ribbed within; outer lip slightly crenulated; interior strongly lirate.

Length, 19; breadth, 10 millim.

Hab.:—Mouth of Tugela River N. by W., distant 18 miles.

Depth, 46 fathoms. Bottom, mud.

This shell is allied to *N. livescens*, Phil., which species varies considerably in its proportions, &c., but the ribs are more distant, and the spire seems to be invariably more sharply acuminated.

NASSARIA GRACILIS, n. sp. (Plate II. fig. 10). Shell whitish, suffused with light brown, fusiform, spire acute, turreted; whorls 10, the first $1\frac{1}{2}$ rounded, smooth, the rest roundly convex, longitudinally strongly ribbed and delicately striated, spirally lirate; ribs rather thick and prominent, crossed by the spiral ridges of which (in the penultimate and antepenultimate whorls) the two middle ones are the most prominent, and, being raised in crossing the ribs, give a biangular character to the whorls; suture linear, not channelled. Last whorl about half the total length of the shell, roundly convex, constricted below the middle, and terminating at the base in a slightly reflexed rostrum of moderate length, and outside the aperture in a thick, broad varix. Aperture subovate, strongly lirate within; outer edge sharp, very slightly reflexed; columella covered with a thin callus, which is raised in a sharp ridge above the umbilical region; canal moderately long and reflexed.

Length, 23; breadth, 12 millim.

Hab. :—Tugela River mouth N. by W. $\frac{3}{4}$, W., distant $15\frac{1}{2}$ miles. Depth, 40 fms. Bottom, mud.

Compared with *N. acuminata*, Reeve (Triton) this shell is smaller, narrower in proportion to its length, its longitudinal ribs are more numerous, and the transverse liræ more defined and distant.

Lotorium ranelloides, Reeve, Proc. Zool. Soc. 1844 (Triton), Conch. Icon. Triton (Plate III. fig. 10).

Hab. :—Scottsburgh Light-house, Natal N.W. by W., distant 8 miles. Depth, 92 fms. Bottom, sand and shells.

The shell is narrower, and the tubercles smaller and more numerous than in Reeve's type. Similar specimens have been received from Japan. Reeve gives—Island of Luzon, Philippines, as the locality.

Lotorium nassariforme, n. sp. (Plate II. fig. 7). Shell fusiform, rather solid, yellowish white, interruptedly banded with brown, with a narrow white zone just below the periphery. Spire acuminate, acute, rather long; whorls $7\frac{1}{2}$, apical ones regular, the first minute, the third decussated with thin, rather distant, longitudinal and spiral liræ; the remaining whorls are rather convex, closely nodulosly ribbed, spirally striated, and furnished at irregular, distant intervals with rather prominent, slightly reflexed, granular and tubercular varices. Last whorl about half the entire length of the shell, somewhat inflated, contracted below the periphery, and terminating in a somewhat oblique, slightly recurved, rostrum. Aperture rather small, suboval; lip white, with the outer margin thin, slightly reflexed, and spotted with brown; inner margin thickened, with seven prominent tooth-like projections, the hinder one being the most prominent; columellar lip irregularly plicated, with a rather thin, expanded callus, and a prominent tubercle near the posterior extremity: anterior canal slightly reflexed, with a narrow opening, widening at the extremity. The entrance to the aperture of the shell on the columellar side is decussated and coloured between the decussating ridges with square brown spots.

Length, 35; breadth, 18 millim.

Hab. :—Scottsburg Light-house, Natal N.W. by W., distant 8 miles. Depth, 92 fms. Bottom, sand and shells.

This species, undoubtedly a *Lotorium*, has much the form of a *Nassaria*. Superficially, the shell has something in common with *L. ranelloides*, but it is manifestly distinct from that species, being very much more closely tubercled, and having no posterior canal.

Bullia (Buccinanops) annulata, Lamk. (Plate II. fig. 4). Two specimens procured in Algoa Bay. Lat. 33° 50 S., long. 25°54′30″ E. Depth, 24 fms. Bottom, sand, shells, and rock.

The shells of this species are well known and abundant at Port

Elizabeth, &c. The figure of the animal represents the specimen as received in formalin; the length and slimness of the double tail-like appendage at the posterior extremity of the foot being remarkable, and very different from other species of the genus that have been figured.

MELAPIUM LINEATUM, Lamarck (Pyrula)=*Buccinum bulbus*, Wood, Index Test. Supp. p. 12, pl. iv. fig. 8=*Melapium bulbus*, Auct. Dredged at Mossel Bay, 11-19 fms. Bottom, hard, with clean grey sand.

Mr. Edgar A. Smith, in his interesting paper on the genus *Melapium* (Ann. and Mag. of Nat. Hist., March, 1889, p. 267), has pointed out that that figured as *Pyrula lineata* by Kiener, followed by Reeve and others, is not Lamarck's species, but a much larger shell of very different character, which had been described by Schubert and Wagner as *Melapium elatum*. The true *M. lineatum* being identical with the small, compact, finely lined shell called by Wood *Buccinum bulbus*. Mr. Smith places the genus between *Rapana* and *Coralliophila*, though it differs from those genera in having no operculum. He thus describes the animal:—

Foot oval, rather high, not truncate or bimarginate in front, in length about one and a half times the width, pale beneath, bordered all round above the margin with two bright red lines about 2 millim. apart. Head small, compressed. Tentacles 5 or 6 millim. long, acutely tapering. Eyes minute at outer base of the tentacles, on slight prominences. Penis compressed 10 to 12 millim. in length, obtuse at the end. Siphon shortish, moderately acuminate. Branchiæ in two plumes, the right large, the left small. Odontophore most resembling that of *Rapana bulbosa*, consisting of a tricuspid central tooth and a single acute curved lateral. The central tooth is transversely elongate, and the cusps are nearly equal in size—short, acute, and approximated.

LATIRUS IMBRICATUS, n. sp. (Plate II. fig. 1). Shell fusiform, lightish brown, covered with a darker brown periostracum, which consists of scaly, waved lamina. Spire rather long, acute; whorls $7\frac{1}{2}$, the first (apical) smooth, papillary, the rest slightly angular in the middle, scarcely concave above, and armed with stout, somewhat distant, tubercles at the angle, everywhere closely spirally ridged; suture narrowly channelled, irregular. Last whorl armed with two rows of obtuse nodules, rather square in the middle, and terminating in a broadish rostrum. Aperture oblong, interior smooth, stained with purple; columella rather straight, smooth, without plaits; canal broad and open. The outer lip in the type is thin and simple, but the specimen is evidently not fully developed.

Length, 44; width, 20 millim.

Hab.:—Tugela River mouth N. by W., distant 18 miles. Depth, 46 fms. Bottom, mud.

Like *L. abnormis*, described by me in "Marine Shells of South Africa," the shell exhibits no columella plaits. It differs from that species in form, as well as in having two rows of tubercles on the body whorl. The "imbricated" character from which I have given this species its name consists chiefly in its periostracum, but here and there thin, shelly scales are also visible.

FUSUS SUBCONTRACTUS, n. sp. (Plate II. fig. 2). Shell rather elongately fusiform, pale yellow. Spire acutely turreted; whorls 9, angularly convex, spirally closely lirate, keeled at the angle and armed with narrow angular tubercles, passing into short, slightly raised ribs above and below; suture closed, waved; last whorl about two-thirds of the entire length of the shell, almost concavely sloping to the angle, which is very prominent, the tubercles becoming larger and more distant, and the ribs below the angle more prominent, while those above are evanescent; rostrum moderately long and tapering. Aperture subovate; interior white, smooth; outer lip rather thin, with a slight callous thickening, inflexed at the entrance to the anterior canal; columella nearly straight; canal straight, rather narrowly open.

Length, 40; width (at angle), 18 millim.

Hab.:—Cape Natal W. by N. $\frac{3}{4}$ N., distant 11 miles. Depth, 200 fms. Bottom, sand and mud. Procured by shrimp trawl.

An interesting shell, somewhat resembling an extremely angular form of *F. rostratus*, Olivi. The curious contraction and inflexion of the lip at the entrance of the canal appears to be characteristic; although only having seen a single specimen, I cannot be certain of this. It looks like a modification of the same character that is seen in *F. clausicaudatus* hinds (a South African species of which only one specimen is known), where the inflexion of the lip almost closes the canal and continues throughout its length.

ANCILLA OBTUSA, Swainson, Monog. 282, Sowerby. Thes. Conch. vol. iii. p. 62, pl. 211, figs. 15, 16 (shell). H. & A. Adams, Genera, Plate xv. fig. 7 (animal). Three specimens by dredge, Algoa Bay. Lat., 33°50′ S.; long., 25°54′30″ E. Depth, 24 fms. Bottom, sand, shells, and rock.

VOLUTILITHES ABYSSICOLA, Adams and Reeve, Zool. Samarang Moll. p. 25, pl. vii., fig. 6; Watson, Gastropoda of Challenger Exped. p. 285, pl. xv., fig. 1 (shell); M. T. Woodward, Proc. Malac. Soc. vol. iv. p. 121, pl. x. (anatomy).

Four specimens got in shrimp trawl. Lat., 34°43′15″ S.; long., 18°30′ E. Depth, 125 fathoms.

This interesting species was originally described from a very young shell, which remained unique until fully grown specimens were obtained in the Voyage of the Challenger. It was at that time the only known recent example of a genus well known and pretty abundant among the Eocene and Miocene fossils of

Europe and America. The shell of the recent species (V. abyssicola) differs so much from Swainson's type of the genus (*V. spinosa,* Lamk.) in its general form, cancellated structure, the thickening of the outer lip, &c., that in a paper in "Trans. of Wagner Free Institute," vol. 3, pp. 74, 75, Dr. Dall proposes to remove it from the genus *Volutilithes*, and to place it with a group of fossil species which he separates under the name *Volutocorbis*, taking for his type *V. limopsis,* Conrad. In the same paper he describes and figures (Plate VI). a new recent species of what he considers a true Volutilithes, under the name *V. Philippiana,* Dall. After comparing a number of fossil forms in the British Museum, I have come to the conclusion that there is not sufficient ground for the separation, and that it is unnecessary. I think it better to include under the common name *Volutilithes* all the fossil forms, both the recent species and the third species hereafter described.

The late Mr. Martin F. Woodward, whose recent death we all deplore as a great loss to science, as well as to all who had the privilege of knowing him as a friend, thus describes the soft parts:—

External characters—The head is slightly compressed dorso-ventrally, and divided anteriorly by a deep median cleft; these two anteriorly-placed head-lobes are intimately related to the opening through which the introvert is protruded; at first sight they might be thought to represent lips, but this is not the case, the true lips being situated, with the mouth, at the extremity of the introvert. Each head-lobe is deeply grooved on its outer border, and the inferior margins of these grooves meet ventrally behind the false mouth in such a manner that these false lips form a V-shaped thickening on the under side of the head. The tentacles are stout, and related to the upper margins of the grooves in the head-lobes. Behind each tentacle is a short but very stout eye-stalk, bearing a prominent eye on its distal extremity. The foot is very large, and probably capable of great expansion. There is no operculum. The siphon is long and devoid of appendices. The edge of the mantle is bordered by a single row of papillæ.

The pallial complex is in most respects like that of *Voluta ancilla* or of *Neptuneopsis*. The gill and dark-coloured osphradium being identical in structure, and the anal, genital, and excretory orifices are similar in position. The only difference, however, is a striking one, and is due to the entire absence of the characteristic hypobranchial gland, a structure present in the majority of the Rhachiglossa.

The Alimentary Canal—The buccal mass and radula-sac form a stout muscular mass, occupying the greater part of the introvert. As in *Voluta,* two pairs of pre-neural salivary glands are present; one large, branched and whitish pair opens into the œsophagus at its junction with the buccal mass, while the second pair is tubular and yellowish, and unites to form a fine duct,

which, as in Voluta, opens into the floor of the buccal mass in front of the odontophore.

The radula of *Volutilithes* exhibits three teeth in each transverse row. Of these rows there are about 110, but owing to the small size of the teeth the radula is small and delicate. The central tooth is tricuspid, the laterals unicuspid.

For further remarks upon this interesting mollusk see Proc. Malac. Soc. vol. iv. pp. 122-124.

Conchologically, this genus is very closely related to *Voluta*. The tricuspid rhachidian tooth is similar to that of most of the *Volutidae* (as far as known), which, however, unlike this, have no laterals. Having regard to this difference, and to certain differences in the anatomy, the propriety of retaining *Volutilithes* as a genus distinct from *Voluta* is established, and Mr. Woodward even suggests a doubt as to whether it may not be regarded as representing a family apart from the *Volutidae*.

Volutilithes Gilchristi, n. sp. (Plate II., fig. 5). Shell oblong ovate, yellowish white, surface cancellated; spire rather shortly conical; whorls rather convex, longitudinally ribbed, and spirally lirate, separated by a deeply channelled suture, above which the top of the whorl projects in an acute crenulated ridge; last whorl about two-thirds the entire length of the shell, convex, and but slightly attenuated towards the base, with a narrowish concave depression a little below the sutural ridge; longitudinal ribs about 16, elevated at the suture, and gradually becoming obsolete towards the base; spiral liræ rather narrow, becoming stouter towards the base. Aperture narrowly oblong; columella covered with a thick callus; plicæ 6, very small and faint, the anterior one being more prominent than the rest, oblique, thin and sharp; outer lip very thick, smooth and rounded, forming on the exterior a broad, stout border to the whorl, as in the genus *Marginella*.

Length 30; breadth 15 millim.

Hab. :—Cape Natal W. by N., distant 11 miles. Depth, 200 fms.

Pleurotoma Gilchristi, n. sp. (Plate II. fig, 9). Shell elongately fusiform, posterior longer than the anterior, whitish tinged, and banded with pale yellow. Spire elongately turreted, slightly convex at the sides, acute at the apex; whorls 12, apical ones smooth, rounded, regular, the rest sloping, scarcely convex, with a double keel above, beneath which is a deepish rut, and about the middle of the whorl a stouter keel ornamented with rather close-set, gem-like tubercles, the interstices between the keels being ridged and grooved; suture of the upper whorls transversely plicate, and of the lower narrowly canaliculate. Last whorl rather convex with the tubercles, becoming longitudinally narrower, and the keel bearing them less prominent, beneath which there are several acute keels and intervening liræ; the

whorl is also sculptured with numerous obliquely-curved longitudinal plicæ; rostrum of moderate length. Aperture elongately sub-oval; sinus rather deep, and not very wide; canal open, moderately wide, and slightly curved.

Length, 32; width, 11 millim.

Hab. :—Mouth of Tugela River N. by W., distant 18 miles. Depth, 55 fms. Bottom, mud.

This shell somewhat resembles *P. gemmata*, Hinds, but it is larger and somewhat different in detail. It also seems to have affinity with the much larger Chinese species *P. Kieneri*, Doumet.

PLEUROTOMA MARMORATA, Lamarck, Anim. S. Vert. vii. p. 95. Reeve, Conch. Icon (Pleur.) fig. 21 *A.* (*var. maculata*).

The shells resemble in colour and pattern those which are pretty abundant in the China Sea, Philippines, &c., but the keel is less prominent.

Hab. :—Same as last.

TURRITELLA PUNCTICULATA, Sowerby, Proc. Zool. Soc., 1870, p. 253, Marine Shells of South Africa (Plate V. fig. 102).

Several small specimens obtained in large trawl in St. Francis Bay. Lat., 34°2′ 45″ S.; long., 25°10′ E. Depth, 30-34 fms.

SILIQUA POLITA, Wood (= *T. Japonica*, Dunker).

Hab. :—Amatikulu River mouth N.W. by N., distant 10 miles. Depth, 24 fms. Bottom, sand and shells.

This species is very widely distributed. The Japanese and Red Sea shells can scarcely be distinguished, and though the South African specimens sent me not being fully developed, are smaller, they are in other respects similar.

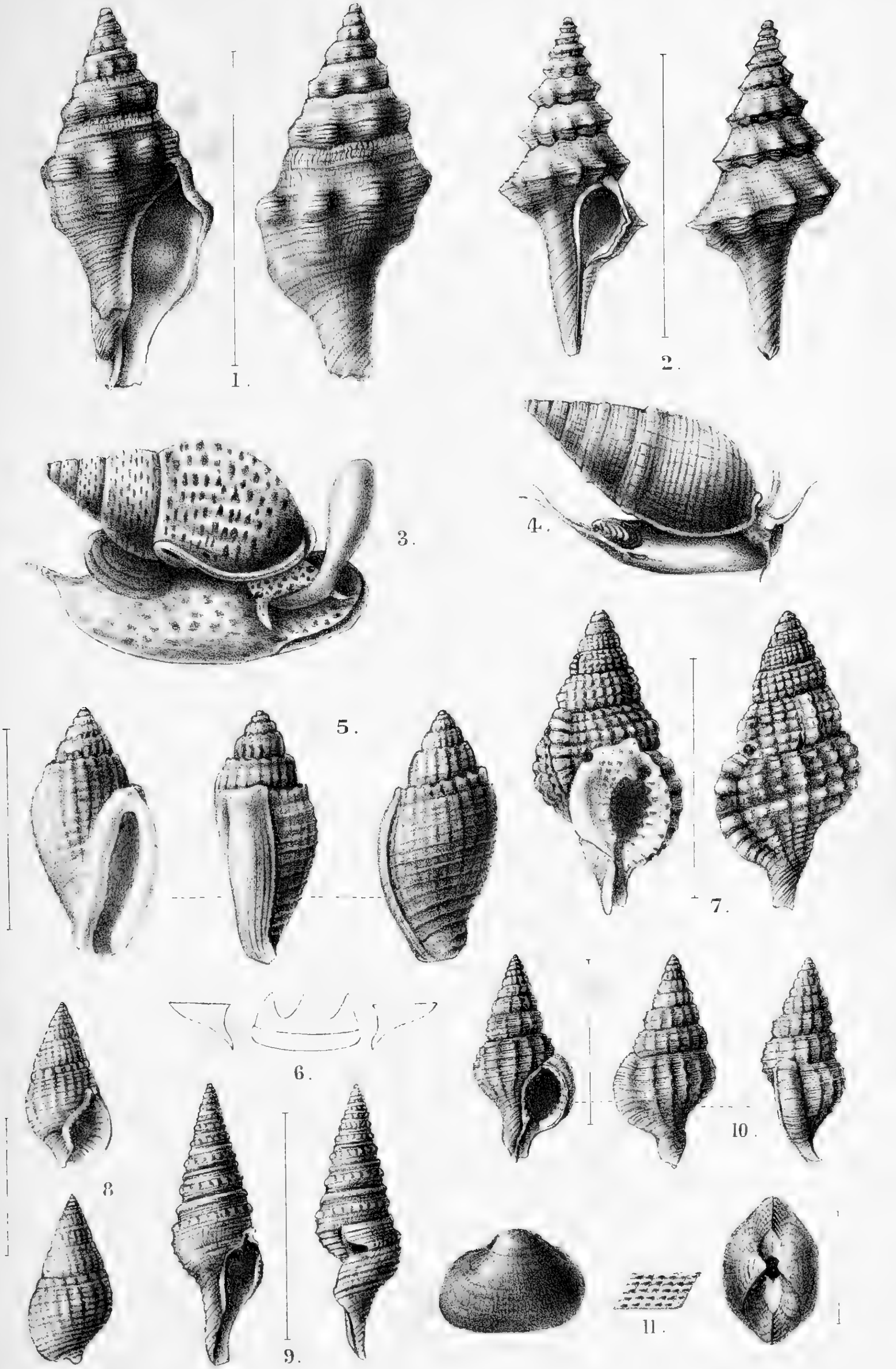
ARCA (BARBATIA) LACTEA VAR. GIBBA, Krauss (Plate II. fig. 11). Sud Afric, Moll. p. 16.

Hab. :—Durnford Point, Natal, N.E. by E., distant 9 miles. Depth, 13 fms. (dredged). Bottom, sand and shells, hard ground.

In figuring this variety, I intended to give it a specific name, relying principally upon its obesity of form and its small diamond-shaped ligament. Upon comparing, however, a large number of specimens of *A. lactea*—British, Mediterranean, and South African—I find them to vary so much in the form of the shell, as well as in the size and shape of the ligament, that I am constrained to adopt Krauss' view that this form is nothing more than a variety.

———:o:———

Published 25th September, 1902.




1. LATIRUS IMBRICATUS. 4. BUCCINANOPS ANNULATA. 7. LOTORIUM NASSARIFORMIS.
2. FUSUS SUBCONTRACTUS. 5. VOLUTILITHES GILCHRISTI. 8. NASSA EUSULCATA.
3. EBURNA PAPILLARIS. 6. „ ABYSSICOLA. (RAD) 9. PLEUROTOMA GILCHRISTI.
10. NASSARIA GRACILIS. 11. ARCA LACTEA VAR.

# SOUTH AFRICAN FISHES,

BY

J. D. F. GILCHRIST, M.A., B.Sc., Ph.D.,

Government Biologist to the Colony of the Cape of Good Hope.

---

The following contribution to our knowledge of South African fishes contains a description of three new genera and four new species.

I have to express my obligation to Mr. G. A. Boulenger, F.R.S., of the British Museum (Nat. Hist.) for his ready assistance and advice in the work.

The following is a list of the fish described :—

1. Choridactylodes natalensis, n.g. et n.sp.
2. Astronesthes boulengeri, n.sp.
3. Melanonosoma acutecaudatum, n.g. et n.sp.
4. Paraliparis australis, n.sp.
5. Paralichthodes algoensis, n.g. et n.sp.
6. Solea capensis, n.sp.
7. Branchiostoma capense, n.sp.

## 1. CHORIDACTYLODES, n.g.

Brianchiostegals six. Body, but not head compressed, a groove in the occiput. Bones of head with osseous ridges ; preorbital, preopercle and opercle with spines. A single dorsal fin with more spines (14-15) than rays (8-9); anal with 2 spines ; pectoral fins with three free rays inferiorly, and with the upper ray prolonged into a hair-like filament ; ventrals with one spine and five rays, articulate fin rays branched, scales absent ; skinny appendages on the body.

This genus is most closely related to *Choridactylus*, Richardson, but differs from it in the number of spines, having one more spine in the dorsal as a rule, but distinctively in the possession of the hair-like prolongation of the upper ray of the pectoral.

## CHORIDACTYLODES NATALENSIS, n.sp.

(Plate V.)

Br. 6, D. XIV-XV+8-9, A. II, 9, V. I+5, P. 8+III.

Length of head $4\frac{1}{2}$, pectoral $4\frac{1}{2}$, caudal 5, height of body $3\frac{1}{2}$ in length of body.

Diameter of eyes $3\frac{1}{3}$ in length of head, a little less than interorbital space and $1\frac{1}{3}$ in distance from end of snout. Interorbital space deeply concave with two ridges, one at each side, forming a lenticular hollow over each eye; a single transverse ridge separates the interocular space from the deep occipital groove.

Four faint ridges cross the occipital groove, two at each side, and these are continued backwards on the humeral region in the form of blunt spines, enclosing a triangular space with a pit-like depression in its centre. Another blunt spine occurs on the humeral region, just above the pectoral. Preorbital has a sharp spine, which in most specimens stands out from the head almost at right angles to it. Its length is about equal the diameter of the eye and it has at its base a smaller spine projecting forward. A ridge of blunt spines runs from the base of the larger spine to the spine ($1\frac{1}{4}$ diameter of eye) of the preoperculum from whence another ridge, with four blunt spines passes obliquely forward and downwards to the angle of the mouth; the operculum has three blunt spines. There is a tasselated tentacle over the centre of the eye and two on each jaw, the anterior being the larger.

Teeth villiform, in jaws not on vomer or palatine. The dorsal fin has, with one exception out of six examples, 14 spines and 8 rays. In the exception, there are 15 spines and 7 rays. The pectoral (8 + III) is rounded and emarginate, having three free rays at its base and a long hair-like prolongation of the first ray reaching to the end of the spinous dorsal. Ventrals attached to body from $\frac{3}{4}$ of their length, black. Anal, black, with white tips to rays, except last four.

The colour varies very much from an almost uniform dark brown to brown and white as shown in the figures. The white band across the caudal is, however, always present. The only parts showing a different colour are the free rays of the pectoral, which are yellowish.

Fleshy filaments on dorsal and pectoral fins and on the body which also has a row of long fleshy filaments (about 9) along the region of the lateral line.

The fish were only found on two occasions, viz.—two on 25th March, 1901, $2\frac{1}{2}$ miles off the Umhlanga River mouth in 22-26 fathoms of water with a bottom of fine sand, and five on the same day and near the same place (Cape Natal Light House bearing S.W. $\frac{1}{2}$ W. (mag), distant 8 miles); depth, 22 fathoms, bottom, fine sand. On both occasions the shrimp trawl net was used and was over in the one case for 2 hours and in the other 40 minutes. In none of the other numerous hauls on the Natal or Cape Colony Coasts were specimens found.

## ASTRONESTHES BOULENGERI, n.sp.

(Plate VI.)

Br. 18, D. 16, A. 15, V. 7, P. 8.

Length of head nearly 5 times in length of body without caudal, its depth nearly 8 times. Depth of body a little more than depth of head. Barbel at least half the length of the head, but probably longer, as it has apparently been damaged. The opercular apparatus is incompletely developed. Near its upper angle a part of the margin is produced backwards as a small lobe.

The dentition is well developed. There are two large curved canines, which, when the mouth is closed, project beyond the margin of the median line of the head. Inside of these towards the symphysis of the jaw is a smaller canine, that of the upper jaw being somewhat larger than that of the lower. At the symphysis there is both in the upper and lower jaws a small bony projection of a triangular shape. Extending backwards from the large canines along the premaxillary and dentary are rows of unequal, very sharp teeth, three in the former, five in the latter. There is a small tooth, scarcely projecting beyond the skin, outside and a little behind the upper large canines, and two small teeth almost on the outer side of the dentary and near the middle of its length. The maxillary is beset with fine unequal and closely set serrations along the distal half of its lower margin. On each palatine is a row of five teeth, small and widely set apart. There are no teeth on the tongue.

The first dorsal is long, originating a little behind the vertical from the ventral and ending slightly in front of the vertical from the origin of the anal. As this and all other fins have been damaged, the length of the rays cannot be determined with certainty. The ventrals are placed near the middle of the body, but a little nearer the head than the root of the caudal. The pectorals are situated

close behind the gill opening. The anal fin commences close behind the anus and under the posterior extremity of the dorsal, ending immediately in front of the supra-caudal luminous gland. There is a small pit in front of the anus. A dorsal adipose fin occurs about half-way between the end of the dorsal and the beginning of the caudal. Its base is about $\frac{1}{2}$ the vertical diameter of the eye, and its free portion reaches to the supra-caudal gland. A ventral adipose fin, very similar to the dorsal though smaller, is also present. The base of attachment is very slightly longer, the free portion, however, being markedly shorter. Both are coloured similarly, being dark brown at the base with brown dots towards the margin.

Phosphorescent organs: These may be divided into three categories. 1st, minute pearl-shaped spots scarcely visible to the naked eye. These are scattered like a cloud of specks over the body and head, showing no regular arrangement, except on the ventral median line, where there are two rows running along the whole length of the body, interrupted only by the luminous glands at each side of the anal fin and by the sub-caudal luminous glands. They also form a ring around the lower half of the orbit and a line inside the margin of the mandible and part of the opercular edge. 2nd, larger pearl-shaped spots quite visible to the naked eye and arranged in rows chiefly along the ventral surface of the body. Their distribution is as follows: 20 alternating with the bases of the 18 branchial rays, 21 between the isthmus and the ventral fin, forming a line bent outwards towards the pectorals at the 7th and inwards at the 18th, where another double series begins, passes backwards between the ventrals and proceeds in 2 almost parallel rows towards the tail, ending in front of sub-caudal gland. They are not interrupted like the line of smaller spots by the glands at either side of the anal fin, but pass on the outer side, though very close to them. The spots in this line number 35. External to this, and almost on the side of the body, are two more prominent lines of spots running in an almost straight line from about the middle of the opercular opening backwards as far as the 3rd ray of the caudal and numbering 35 in all. At the anterior end of this series there is a single spot on the operculum at the base of the small lobe already mentioned. The only other luminous spot on the head region is one situated immediately under the eye. It appears as a small protuberance of the dark skin, which, however, when drawn up is found to cover, like an eyelid, a pearl-shaped organ similar to the others. Five openings, probably glandular, occur along the inferior margin of the lower jaw, devoid of the pearl-shaped organ. 3rd, glandular organs, probably luminous in function. When the fish was taken, these appeared as gelatinous pinkish

patches, now (in spirit) white and of a spongy-looking texture. They are slightly elevated above the surrounding surface of the skin, which can, however, be readily traced passing over them. Their distribution is as follows: One above the caudal region between the dorsal adipose fin and the tail and another in front of this, between the adipose fin and the posterior end of the dorsal, one, slightly divided into two by a median line, on the sub-caudal region between the anal fin and the tail, and two on each side of the anal fin. Three much smaller roughly circular patches occur on the side of the body between the ventrals and anal, about $\frac{1}{3}$ the diameter of the eye. Two smaller streaks, apparently of the same kind of tissue, occur on the ventral surface behind the ventrals; they are not symmetrically placed, the right being nearer to the ventral fin than the left by about its own length.

The loose scaleless skin is very dark brown, almost black, tinged with a bronzy lustre on the postorbital region of the head.

Only one specimen of this fish was obtained. Locality, Cape Point Light-house bearing S. 83° E. (mag.), distant $35\frac{1}{2}$ miles, depth, 360 fathoms. Procured by shrimp trawl.

A much-damaged fish, however, was obtained, 60 mm. in length by shrimp trawl on the East Coast (Buffalo River N.W. by W., distant 21 miles); depth, 490 fathoms, bottom, sand. The dentition and shreds of dark skin seem to indicate that it belongs to the same species. The barbel, which is undamaged in this fish is long, reaching well beyond the posterior extremity of the lower jaw and has a flattened terminal portion. The dorsal has apparently 14 rays however.

Measurements of first specimen.

| | | |
|---|---|---|
| Length of body (without caudal) | 213 | mm. |
| Depth ,, ,, | 35 | ,, |
| Length of head | 45 | ,, |
| Depth ,, ,, | 32 | ,, |
| Vertical diameter of eye | 10 | ,, |
| Length of barbel | 20 (+?) | ,, |

## MELANONOSOMA, n.g.

Head quadrilateral, body compressed, especially towards caudal region, which terminates in a long tapering tail. Mouth wide, anterior and lateral. Both jaws with narrow bands of villiform teeth; teeth on vomer and palatines. No barbel. One long undivided dorsal fin commencing over the pectorals and ending a short distance in front of the caudal rays. One anal, commencing about the middle of the body, similar to the dorsal, not confluent with caudal rays, though separated from them by a short space. Pectorals and ventrals narrow, in the same vertical line. No pseudo-branchiae.

Very near to the genus *Melanonus* Günther, but has not the anterior division of the dorsal described by him. The "posterior division" of the dorsal and anal are present as in his description of Melanonus, but as these are here regarded as part of the caudal the present genus is described as having one dorsal and one anal.

## MELANONOSOMA ACUTECAUDATUM, n.sp.

Br. 7. D. 66. A. 49. V. 5.

Length of head nearly $6\frac{3}{5}$ in length of body. Depth of head and body nearly equal, contained $7\frac{1}{2}$ times in length of body. Diameter of eye 4 times in length of head. The dorsal commences at a point in the vertical from the pectoral and ventral, and consists of feeble rays bound together by a very delicate membrane, the longest occurs in the anterior part, and is a little more than half the length of the head. The anal commences immediately behind the anus and under the 21st ray of the dorsal. It is similar to the dorsal though more delicate, and its longest rays are only about half the length of those of the dorsal. The posterior rays of both dorsal and anal overlap the small caudal rays, reaching to about the 3rd or 4th when laid along the body. There are about 50 rays in the caudal, four of the posterior median are prolonged, being longer than the longest dorsal by about a $\frac{1}{3}$ of its length. The caudal region bears a very close resemblance to that of Melanonus. A series of 5 scales between the dorsal and lateral line and 9 between lateral line and ventral median line. A large mucous pore immediately above the eye and many smaller ones scattered over the

upper surface of the head; about 5 large pores under the orbit, three under the mandible. The colour of the fish is an uniform dark brown.

It was procured by shrimp trawl off the Cape Peninsula (Cape Point Light-house bearing S. 83° E. (mag.) distant $35\frac{1}{2}$ miles); depth, 360 fathoms, bottom, black specks. Only one specimen has as yet been got.

Measurements of specimen.

| | | | | | |
|---|---|---|---|---|---|
| Head, length | 16 mm. | Longest ray of dorsal | | 9 mm. |
| „ depth | 11 „ | „ „ „ | caudal | 12 „ |
| Body, length | 85 „ | „ „ „ | anal | 5 „ |
| „ depth | 11 „ | Eye | | 4 „ . |

## PARALIPARIS AUSTRALIS, n. sp.

(Plate VII.)

D. 48. A. 43. P. 14 + 3. C. 9.

Height of body contained $3\frac{2}{3}$ times in length without caudal. Length of head over 4 times. Snout broad, truncated, longer than diameter of eye, which is $3\frac{1}{3}$ in length of head. Interocular space is greater than postorbital portion of head and is $2\frac{1}{3}$ times the diameter of the eye. No rays in space separating the two portions of the pectoral. Nostril immediately in front of eye, about 6 mucous pores in a line along the side of upper jaw and under eye. Two occur at symphysis of lower jaw, close together, having one external opening. A row of 5 extending along lower jaw and opercular region to the narrow gill opening; the last opposite the gill opening, is much smaller than the others. Teeth of upper and lower jaws in closely set pavemented band. The origin of the dorsal is behind the base of the pectoral, and that of the anal below the 6th ray of dorsal. Length of middle caudal ray $7\frac{2}{3}$ in length of body, the dorsal overlaps the caudal more than the anal and to about $\frac{1}{4}$ of the length of the caudal. No trace of a ventral fin. The vent as seen in the smaller and uninjured specimen is far forward, just behind a line between the pectorals.

Skin is very loose and scaleless. The larger specimen appears to be colourless, with the exception of the eye and visceral mass, which are black. Examined with a low power, however, the loose skin and body under it are seen to be speckled with minute black dots. In the smaller these are distinctly visible to the naked eye as a somewhat dark colouring, most marked along the whole dorsal region.

The specimen appears to represent a new species, as it differs in fin formula and has no trace of rudimentary rays between the division of the pectoral. In view of the comparatively small size (50 mm.) as against 200 of the mature specimen secured and described by Collet, and the $7\frac{1}{2}$ inches of that described by Günther, it might be considered an immature form of *P. bathybius.* It has, however, the ovaries well developed, with large eggs, which are apparently ripe, being about 1 mm. in diameter. The mouth of one of the specimens was filled with crushed schizopods, a fact probably indicating a pelagic habit.

The number of known species of the section of the Discoboli without ventral disc (the genus Paraliparis in the wider sense) is limited. *P. bathybius* has been obtained near Bear Island in 658 fathoms, and by the "Knight Errant" at Station 8, 1882, in 640 fathoms; P. laparinus has been obtained by the "Fish Hawk" at several stations near 39° N. lat., 70° W. long., at depths between 300 and 600 fathoms. *P. copei* at about the same locality and depth, and *P. membranaceus* (one specimen) by "Challenger" off Cape St. Vincent from 40 fathoms The occurrence of a representative at the Cape of Good Hope considerably widens the distribution of this interesting group of fishes. The two specimens were obtained by shrimp trawl, 40 miles W. by N. of Table Mountain at a depth of about 300 fathoms. The larger had the abdominal cavity considerably injured; the smaller was little injured.

## PARALICHTHODES, n.g.

Dorsal fin commences before eye on the snout, anterior rays branched and separate. Eyes on the right side. Teeth very small and in several rows. No teeth on vomer or palatines. Lateral line curved strongly. Scales not ciliated. Strong anal spine. Ventrals unsymmetrical, right in front of left and in the median line.

Nearest to *Paralichthys* (Girard in U.S. Pacif. R.R. Exped. Fishes, p. 146.)

## PARALICHTHODES ALGOENSIS, n.sp.

(Plate VIII.)

D. 72. A. 52. V. 6. L. 1. 118+8.

Body moderately elongate, its height contained in its length (without caudal) over $2\frac{1}{2}$ times, head a little over $4\frac{1}{3}$ times. Breadth of tail $2\frac{2}{3}$ same as in head.Eyes on the right side, lower

very slightly in advance of upper. Teeth small and in 3 more or less distinct series in upper and lower jaw. Lower jaw projects beyond upper by about $\frac{1}{2}$ the vertical diameter of the eye. Maxillary of left side more exposed than that of the right; the latter extends backwards beyond the centre of the lower eye. Longitudinal diameter of eye greater than vertical diameter and a little less than twice the interocular space. The dorsal fin originates on the snout nearer to its anterior extremity than to the eye, the first ray is inserted a little to the left of the median line, and is entirely separate from the second. It is divided into 6 branches. The second and third are slightly joined at the base, but are still to the left of the median line. The fourth and subsequent rays are in the median line and the branchings of the rays gradually become fewer till near the middle of the body they are simple, again showing a dichotomous division towards the posterior end. Longest ray of dorsal equal to that of anal and contained $2\frac{2}{3}$ in length of head. Anal ends near caudal, but separate from it. The right pectoral is longer than the left and about $1\frac{1}{2}$ in length of head. The right ventral is slightly longer than the left, the former being on the median line and nearer the head, the distance between the origin of anterior rays of each being equal to $\frac{1}{3}$ the horizontal diameter of the eye. The caudal is rounded and covered with scales to near its posterior margin. There are about 118 scales in the lateral line of the body and 8 on the caudal.

The colour of the specimen is now (in spirit), on the right side, an uniform dark brown with small spots of darker colour on head and anterior region of body. The left side is colourless.

No example of this fish has been found in the numerous trawlings of the Government steamer, and none have been got from fishermen. The single specimen was found in the Museum at Port Elizabeth, the Curator of which kindly handed it over for description. He informed me that it was found in Algoa Bay.

Measurements of the specimen.

| | | | | | |
|---|---|---|---|---|---|
| Length of body (excl. tail) | 345 | mm. | Interocular width | 85 | mm. |
| ,, ,, ,, (incl. ,, ) | 410 | ,, | Length of right pectoral | 48 | ,, |
| Depth of body | 134 | ,, | ,, ,, left ,, | 30 | ,, |
| Breadth of tail | 30 | ,, | Longest ray of dorsal | 30 | ,, |
| Length of head | 80 | ,, | ,, ,, ,, anal | 30 | ,, |
| Diameter of eye (horizontal) | 15 | ,, | Left ventral | 24 | ,, |
| ,, ,, ,, (vertical) | 11 | ,, | Right ventral | 26 | , |

## SOLEA (PEGUSA) CAPENSIS, n.sp.

(Plate IX.)

D. 79-87, A. 63-68, L. l. 113-115.

Eyes on the right side, upper in advance of lower by about $\frac{1}{3}$ its breadth. Snout hooked, mouth unsymmetrical, extending nearly to below centre of lower eye. Teeth minute, on the blind side only. Gill openings moderately wide, with fringe of papillae along edge. Head, snout, lips and extremity of nostril of blind side covered with papillae. Nostril of blind side dilated and surrounded by space destitute of papillae. Depth of the body is contained nearly $2\frac{1}{2}$ in total length (without caudal), length of head $5\frac{1}{2}$. Longitudinal diameter of the eye is contained 5 times in length of head and is about twice the breadth of the interorbital space. The dorsal fin commences well forward on the snout at a point on a level with the centre of the upper eye. The number of rays vary in the different specimens from 79 to 87. The longest of these occurs about the centre and is contained $2\frac{1}{3}$ in the length of the head. The posterior extremity of the dorsal is close to the caudal, but distinct from it. The anal fin commences immediately behind the ventral, and runs backwards, ending close to the caudal as in the case of the dorsal. It contains from 63 to 68 rays. The right pectoral is contained $2\frac{1}{2}$ times in the length of the head, being slightly longer than the left. It is covered with scales to $\frac{1}{3}$ of its length. The caudal is obtusely rounded and is contained $9\frac{1}{2}$ times in the length of the body. The breadth of the tail, between the extremity of the vertical fins, is about $\frac{1}{2}$ the length of the head.

Scales strongly etenoid on the right side, cycloid on the left. Lateral line straight with 113-115 scales.

Colour in fresh state, brown, with shades of green, and dark brown and greenish blotches of irregular size and shape, sometimes assuming the form of rings with a brown spot in the centre. These are smaller, more closely set and irregular in shape on the caudal dorsal and anal fins and on the head. The pectoral fin is coloured in a similar manner to about $\frac{1}{2}$ its length, the distal portion being dark brown and the tips of the rays yellowish white. The iris is of a sandy yellow colour, with black dots, except in its inner margin, where it is of a golden yellow colour. The blind side is colourless, except the papillae, which are ochreous yellow, occasional patches of the same colour appearing on the left side of the unpaired fins, especially the caudal. On these fins also dark streaks appear between the rays. The left pectoral is of a pinkish colour at the base and light brown, sometimes black, on the distal half. In one specimen however this fin was entirely devoid of colour.

This sole is apparently confined almost exclusively to fairly shallow water. Specimens were procured from Fish Hoek and Muizenberg (in False Bay) by seine net. No specimen has been procured in the frequent trawling operations of the Government vessel in this locality, nor to my knowledge in the subsequent trawling operations of other vessels. One specimen only has been procured by the Government steamer, $4\frac{1}{2}$ miles off Cape St. Blaize, in 30 fathoms (mud). It was in a much poorer condition than those caught in the shallow waters of False Bay. Two specimens, said to have been found in Algoa Bay, were procured from the Port Elizabeth Museum.

Length, 338 mm. (including caudal).

## BRANCHIOSTOMA CAPENSE, n.sp.

(Plate X.)

Myotomes $47+19+9$. Length 39 to 48 mm. Dorsal fin low, rays commencing over first myotome, attains its greatest height a little in front of the vertical from the anus and in several specimens shows the characteristic lancet shape of *B. lanceolatum*, but in others this is not so marked; about the middle of the body its height is $7\frac{1}{2}$ in that of body. The anal fin is somewhat deeper than the dorsal and extends from the posterior extremity of the body to the atrial opening, the border being uninterrupted with no trace of the lancet-shaped outline as in the dorsal; it is not continuous with either of the metapleural folds and has fin rays at its base. The oral cirri are 36 in all; the basal pieces forming a ring which is interrupted at the upper part where the last segment on each side bears four very small cirri; the anterior part of the ring falls under the second myotome. The cirri are connected by a low membrane to about $\frac{1}{5}$ of their length. The dorsal fin after passing over the anterior extremity runs along the ventral side into the right buccal fold, the origin of the left buccal fold being thus not in the median line, but on the left side.

There appears to be no pigmented spot or "eye" in front of the nerve chord, but there is a series of very distinct black spots running along the top of the chord, beginning from about the 3rd segment and extending to near the posterior end. This line of spots appears broken up roughly into groups, there being a tendency to aggregate at each muscular segment.

In a specimen examined by staining and mounting in balsam there were 30 gonads on the left side, the first in the 18th segment, the last in the 47th. A similar number was found on the right side.

The species seem to occur on the South and East Coasts having been found at the following places :—

| Locality. | Depth in fms. | Natnre of bottom. | No. procured. | Size in mm. |
|---|---|---|---|---|
| False Bay (Rockland Pt. N.W. $\frac{1}{4}$ N., $2\frac{1}{2}$ miles.) | 23 | Rock with many sponges. | 1 | 39 |
| False Bay (Roman Rock, N.W. $\frac{3}{4}$ N., $\frac{3}{4}$ mile.) | 18 | Sand and shells. | 3 | 42, 42 and broken specimen. |
| False Bay (Bakkoven Rock, W. $\frac{1}{4}$ N., $\frac{3}{4}$ mile.) | 22 | Broken shells. | 2 | 42 and 26. |
| False Bay (Paulsberg, W.N.W., 1 mile.) | 24 | Sand and shells. | 1 | 48. |
| Mossel Bay (Cape St. Blaze, N., 1 mile.) | 19 | Fine sand. | 4 | 35, 27, 39 and broken specimen. |
| Algoa Bay (Lat. 33°, 52′, 30″ S., Long. 25°, 50′, 33″ E.) | 25 | Fine sand. | 2 | 38 and 39. |
| Algoa Bay (Lat. 34°, 2′ S., Long. 25°, 45′, 30″ E.) | 29 | Fine sand. | 3 | 39, 47 and broken specimen. |

The majority of the specimens secured were unfortunately so damaged in the dredge that a careful comparison of the number of segments in all was found impossible. It is probable, however, that subsequent dredgings will produce them in abundance now that their habitat is known.

They have not yet been found in the colder waters of the West coast. In addition to these specimens procured by the Government steamer I found one in the collection of the South African Museum, which I am informed by the Assistant Director, Mr. Péringuey, was procured about 20 years ago from Simon's Bay.

The occurrence of Branchiostoma in South African waters is interesting as filling an important gap in the geographical distribution of this interesting form. The following table, containing the names of the known species with the approximate number of myotomes and place of occurrence, will indicate the taxonomic position of this new form as based upon the number of myotomes and also its relative geographical position :—

| Species of Brachiostoma. | No. of Myotomes. | Distribution. |
| --- | --- | --- |
| B. cultellum | 32+11+10=53 | N. Australia. E. Australia. |
| B. caribaeum | 35+14+ 9=58 | S. America. S. United States. Antilles. |
| B. lanceolatum | 36+14+12=62 | Europe. Chesapeake Bay ? |
| B. cingalense | 39+17+ 6=62 | Ceylon. |
| B. nakagawae | 37+16+11=64 | Japan. |
| B. belcheri | 37+14+13=64 | Borneo. N. Australia. |
| B. lucayanum | 44+ 9+13=66 | Bahamas. |
| B. pelagicum | 36+16+15=67 | Honolulu. |
| B. californiense | 44+16+ 9=69 | California. |
| B. bassanum | 44+13+18=75 | S. Australia. |
| B. *capense* | 47+19+ 9=75 | *S. Africa.* |
| B. elongatum | 49+18+12=79 | Peru. |

It would appear from this table that the African form somewhat resembles B. bassanum, Günth., both from the similarity of the number of myotomes (75 in all in both cases) and geographical position, the most distinctive difference being in the number of myotomes of the caudal region.

---

[PUBLISHED 7TH OCTOBER, 1902.]

Fig. I.

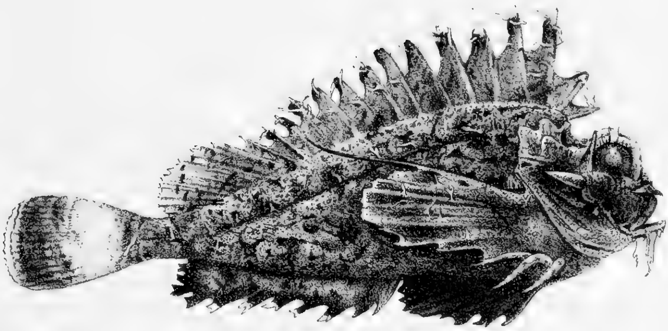
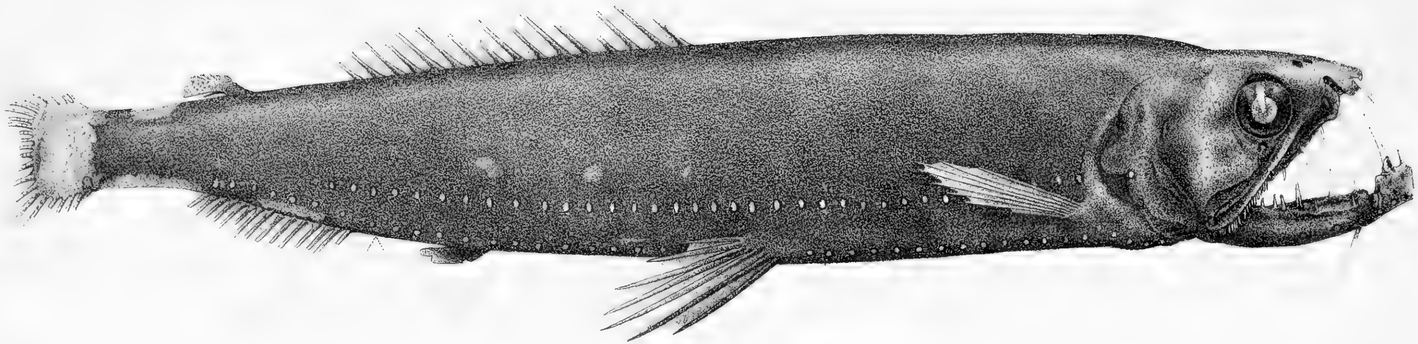


Fig. II.

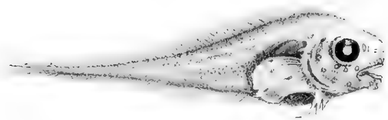
L.A.Brimble del.

Mintern Bros. lith.

Figs. I. II. CHORIDACTYLODES NATALENSIS. Nov. gen. et spec.



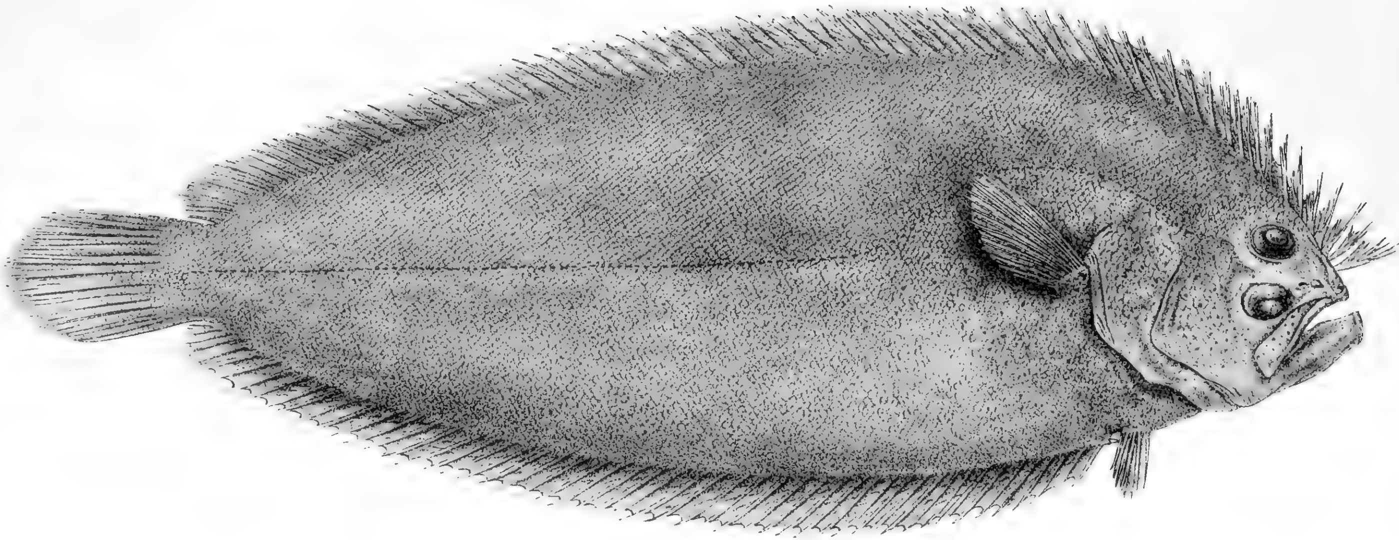
ASTRONESTHES BOULENGERI. Nov. gen. et spec.



I. A. Brimble del.

Mintern Bros. lith.

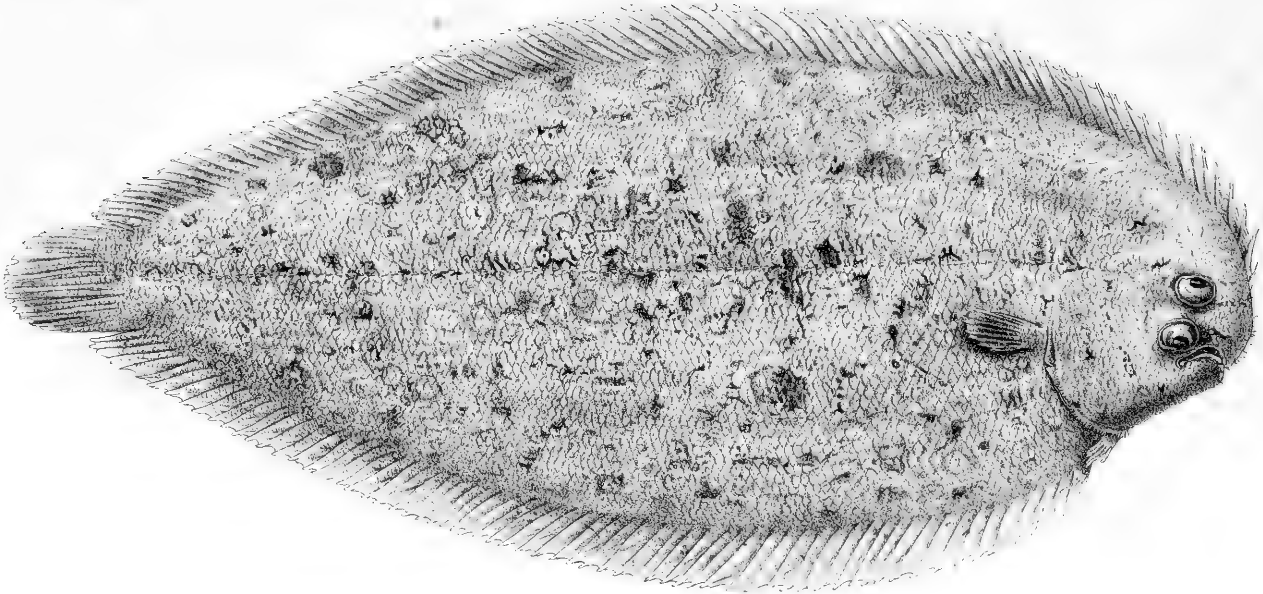
PARALIPARIS AUSTRALIS. Nov. sp.



L.A.Brimble del.

Mintern Bros. lith.

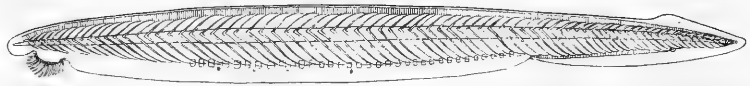
PARALICHTHODES ALGOENSIS. Nov. spec.



L. A. Brimble del.

SOLEA CAPENSIS. Nov. spec.

Mintern Bros. lith.



L. A. Brimble del.

Mintern Bros. lith.

BRANCHIOSTOMA CAPENSE. Nov. sp.

# SOUTH AFRICAN CORALS OF THE GENUS *FLABELLUM*, WITH AN ACCOUNT OF THEIR ANATOMY AND DEVELOPMENT,

BY

J. STANLEY GARDINER, M.A.,

FELLOW OF GONVILLE AND CAIUS COLLEGE, AND DEMONSTRATOR OF ANIMAL MORPHOLOGY IN THE UNIVERSITY OF CAMBRIDGE.

---

## CONTENTS.

---

## 1. INTRODUCTION.

The present paper forms the first part of an account of a remarkably fine collection of corals from the Cape of Good Hope, entrusted to me for identification. Most of the specimens appear to have been preserved in *formalin*, an excellent reagent, but one which is somewhat uncertain in its results. To give an instance, corals of the genus *Flabellum* are almost uniformly well preserved, while those of *Caryophyllia* are almost useless for anatomy. In any case the examination of more than the gross anatomy of the polyps of the various species, or forms, in the different genera is not, in view of the results obtained in the present genus, particularly to be desired.

The collection is of peculiar interest from the fact that the same forms have been repeatedly dredged in slightly or considerably different localities. Thus the variation due to different habitats may subsequently be worked out, and correlated perhaps with the physical and other conditions. For this purpose accurate charts for each locality of the temperature of the sea, of the character of the bottom, and of the currents both on the surface and to the bottom are desirable, as well as a knowledge of the topography and the fauna and flora. The present and further collections will give a correct knowledge of the "normal" or "continuous" variations in each species, and it may be hoped that the presence and nature of "discontinuous" or "specific" variation in the group may be elucidated. At the same time the accurate knowledge of the coral fauna in any one locality *in relation to its environment* must necessarily be of immense value in deducing the conditions under which tertiary and earlier coralline deposits have been formed, in effect in studying the history and geography of the earth.*

Most workers on the systematic side complain of the enormous difficulty of determining the species of corals. This seems to me to be more apparent than real. It has probably arisen largely owing to the not-unnatural desire to refer each specimen to a species—to give each a convenient handle by

* The above paragraph was written before I received the "Report of the Government Biologist for the Year 1900." I find therein most or all the information I desire as to the environment, physical conditions, etc.

which to grasp it—while nothing may be known of its habitat, its locality alone being broadly indicated. Most collections, too, if they contain many colonial forms, are small in specimens, so that variability cannot be properly studied. Lastly, it must be recognised that sedentary animals vary in accordance with their surroundings in the same way as do trees and other plants.

Having determined which are the species in any collection, it is necessary to examine into the question as to whether these species are already known or new. This is a far more perplexing and arduous task.* So far as my experience goes, I find that there are in each genus only a limited number of characters, which vary in a species-making manner. Most of the other characters are those of the family and genus, and require no particular remark. The rest are of but small importance, and belong rather to the individual than the species. They become eliminated necessarily as a larger and larger number of examples is studied. In the earlier descriptions the recorded characters often do not include those on which the species are necessarily founded at the present day. Later workers may have recorded these from an examination of the same specimens, or elucidated them from others. In the latter case there must always be some element of doubt, but this is unavoidable. Again, if the variability *owing to environment* may be expressed as from 1 to 100, the original specimens—especially if few in number, as is usually the case—may be placed between 1 and 10 or 90 and 100, while the great bulk of subsequent collections will be about 50. Specimens may in the first place be put as species at every tenth, but as more specimens are examined the intermediate forms must be necessarily joined together, until finally the limits of the real species are elucidated.

The personal element of each worker in the field is—and must always be—enormous, but the remedy lies in the systematic study of the normal variation of different species, particularly in relation to the physical and biological characters of its environment. It may then be possible to separate the variability of the species *per se* from that due to external causes, by this means possibly arriving at some more accurate conception of the formation of the species themselves.

* Vide "Some Fossil Corals from the Elevated Reefs of Curacoa, etc.," by T. Wayland Vaughan, Samm. des Geol. Reichs-Mus. Leiden, Ser. II., Bd. II., Heft I. (1901).

## 2. GENERAL.

The genus *Flabellum* is characterised among the Turbinolidae by having a well-defined "epitheca," and together with this the absence of any structure, which may be termed a "theca." The genus *Antillia* shows typically the difference between "theca" and "epitheca." The first is the wall—be it formed as a basal deposit or by thickenings of the septal sides—surrounding the digestive cavity of the polyp, while the latter closes off such parts of the anemone as may lie outside the "theca" from the external medium, *i.e.*, the sea-water. According to this definition the "theca" should be covered on and formed from both sides by the tissues of the polyp, while the "epitheca" is only so covered on and formed from one, *i.e*, the inner side. Accepting the fact that the skeleton lies completely external to the polyp—a reality not within the knowledge of the proposers of the terms—the above forms a reliable and indeed the only distinction, unless it be subsequently shown that the two are formed essentially differently from one another.

"Costae" correspond to the septa, and are their continuations outside the theca. The theca is not formed before the septa, but may be built up *pari passu* with their formation. More often the septa are formed first, and from the beginning project above the theca, *i.e.*, are "exsert." In *Antillia* the edges of the "costae" are fused with the epitheca, but in most forms there is no such epitheca, and they are hence covered over outside by the soft tissues. Where epitheca alone is present—as in *Flabellum*—there can be no costae, although raised ribs of the epitheca may simulate them. The term "exsert" applied to the septa also bears relation to the presence of a theca, and cannot properly be applied where none such is present.

The only case, where there can in practice be any doubt between theca and epitheca, is where a theca without costae has been formed. In such a case, if the edge-zone of the polyp—that part which lies external to the theca—withdraws completely, there may actually be no tissues external to the wall. The latter, if a theca, always shows in section a definite dark line along its centre, and in a living polyp some of the top or upper part of the wall would still necessarily be covered by an edge-zone. There would further be no distinction between the inner and outer sides of such a theca. A possible extreme case would be where the calicoblastic ectoderm of the edge-zone in its retreat deposited a special coating of carbonate of lime. The glassy appearance of *Desmophyllum* in its lower parts indicates the downward extent of the edge-zone, and may be due to such a deposit. This, however, does

not really in any way resemble a true epitheca, and the presence or absence of a central dark line in section can leave no doubt as to its homologies.

Where an epitheca is present, there can be no budding from outside the same, no external tissues existing. If buds are found, as are stated to exist in *Blastotrochus*, they must be due to the epitheca being imperfectly formed, so as to allow the tissues of the polyp to project freely at certain parts of the surface.

The "columella" may be "essential" or "parietal," true or false. In the first case, it arises on the basal plate as a central deposit, to which the septal edges may secondarily be attached. A "parietal columella" has no such basal deposit, but is formed by the tissues which cover the larger septa, fusing across the coelenteric cavity and joining them by trabeculae of corallum. The two modes of formation are morphologically quite distinct from one another. I, hence, apply the name only to the "essential" or true columella. In many genera, the development being unknown, it is not clear whether there is a true columella or not. In such, as the deposition of a central pillar of carbonate of lime must be regarded as the more primitive mode of formation, I assume the presence of a true columella.

"Pali" also are of two kinds, true and false. The former arise as deposits on the basal plate, while the latter are the mere thickened edges of the septa, or formed by trabeculae from the same. The true pali are often, and indeed generally, secondarily joined to the septal edges either by trabeculae or along their whole length. Where a coral is truncated, it follows that true pali *can* only be present in front of those septa which are primarily formed on the basal plate. Additional orders of septa, added during growth, can have no pali, unless (as is conceivably the case in some of the Astraeidae) the original pali become branched.

## 3. **The Genus** FLABELLUM.

*Flabellum* Lesson, Illustr. de Zool., 1831.

*Flabellum* Milne Edwards et Haime, Ann. des Sc. nat., 3e ser., t. IX., p. 256 (1848) and Coralliaires, t. II., p. 79 (1857).

*Blastotrochus* Milne Edwards et Haime, Ann. des Sc. nat., 3e ser., t. IX., p. 284 (1848) and Coralliaires, t. II., p. 99 (1857). Semper, Zeit. für. wiss. Zool., Bd. XXII., p. 237 (1872).

*Rhizotrochus* Milne Edwards et Haime, Ann. des Sc. nat., 3e ser., t. IX., p. 281 (1848) and Coralliaires, t. II., p. 97 (1857).

*Flabellum, Blastotrochus* and *Rhizotrochus* Duncan, Jour. Linn. Soc., vol. XVIII., pp. 13-15 (1885).

Duncan divided the Turbinolidae into a number of "alliances" of which the second is the "Flabelloida," comprising the recent genera *Flabellum*, *Rhizotrochus* and *Blastotrochus*. These are characterised by being "simple forms with no theca and hence costae. There is no true columella, but the septal edges may fuse by trabeculae and fill up the axial fossa. The forms are fixed or free, with or without rootlets, and generally more or less compressed." As above defined the group is perfectly and morphologically distinct from any other division of the Turbinolidae.

The fossil genus *Thysanus* I have not been able to examine, but the three recent genera do not seem to me to present any real points of difference. *Blastotrochus* is said to differ from *Flabellum* by budding occurring at the sides between the calicular margin and the base, the buds falling off and growing. Of *Flabellum rubrum* I have examples with young individuals growing similarly to the above between the calicular margin and the base. They are attached principally to one or other end of the calicle, but may lie on the sides as well. All are completely cut off from the soft tissues of the polyp, and there are no indications in any single case as to whether they have been definitely budded off, or whether they have been formed by the attachment of free-swimming larvae. If the former be the case, a small portion of the polyp must have been cut off by the advancing epitheca of the parent, as there is now no trace of any connection, even the youngest having indications of its own basal plate separating it from the epitheca of the older corallite. In two *supposed* specimens of the original type *B. nutrix* from the Phillipines I can find no indication of definite budding, nor of any difference between the mode of attachment of the buds to that found in *F. rubrum*. In reference to Semper it is necessary to point out that he presumably supposed the corallum to be of endoderm formation, and it is interesting to note that his specimens of *B. nutrix, F. irregulare* and *F. variabile* all came from the same habitat, *i.e.*, the channel of Lapinig from 6-10 fathoms. The presence of young attached forms appears to me to be perhaps an accidental circumstance. In any case I cannot deem it of sufficient importance to separate *Blastotrochus* from *Flabellum*.

*Rhizotrochus* has hollow rootlets communicating with the coelenteron of the large polyp, or with the interior of the calicle of the dried corallites. I shall subsequently in *F. rubrum* have occasion to show that in some specimens there are rootlets found, precisely similar to these. Duncan states as a further character that "the columella is absent, and the

septa either unite by a few trabeculae or join across the axial space." In *Flabellum* there is no columella, but the septal edges unite by trabeculae in absolutely the same way. In *F. rubrum* there is often very little such fusion of the septal edges, indeed not more than is found in some specimens of *R. fragilis* Pourtalès and *R. tulipa* Pourtalès. In *R. typus* Ed. & H., *R. affinis* Duncan and *R. levidensis* Gardiner there is no such fusion, but the above species of Pourtalès are in this respect intermediate. Ed. & H. remark that in *R. typus* the larger septa have in the young traces of trabeculae, which disappear in the adult. How far the presence or absence of a false columella can be regarded at all as a generic character is doubtful, but certainly in this case there is no valid reason for separating *Rhizotrochus* from *Flabellum*.

The characters of the genus *Flabellum* would be practically synonymous with those of the alliance Flabelloida, as given above, and hence need not be repeated.

The chief distinguishing characters of species within the genus *Flabellum* appear to be (1) shape as seen in side view and looking into the calicle as well as in transverse sections of the calicle: (2) if the corallum be free, whether there has been a distinct rupture of the stalk, leaving a scar or not: (3) the number of septa fusing together by their septal edges or the number of equal septa of the lowest cycles: (4) if compressed, the presence or absence of wings or hollow epithecal processes, or possibly both, or if round, the presence or absence of root-like processes. As Semper has shown, and as will be subsequently seen in *F. rubrum*, (3) and (4) may require a large number of specimens to ascertain definitely these characters, but in some forms they become of primary importance (those cited above formerly placed in genus *Rhizotrochus* and others). (2) appears to be correlated with changes of shape. (1) varies considerably in any species, but the vast majority of specimens in each species approach to a distinct, central type. The shape within the genus varies greatly, some species being compressed, others round or angular. In some species the epitheca, as a flat plate, joins the outer edges of the septa and in others forms festoons between the same. In some the upper edge of the epitheca follows regular curves, the septa all attaining the same height, and in others is quite irregular, some cycles of septa rising higher than others.

Of supplementary characters the septal contours depend largely on the shape of the corallite, but the distances between the spined ridges on the septal sides may be of some importance. The latter vary somewhat in individuals of presumably the same age—judging by their accretion-lines—and of similar size and shape. Much more then do they vary

in specimens of different rates of growth. Measurements are unreliable, as would also be any dealing with the distances between accretion-lines, unless several hundred specimens of each species had been examined.

The consideration of the specific variability of the polyps must be deferred to the last section of this report, when the anatomy of our species will have been dealt with.

## 4. FLABELLUM PAVONINUM. (Plate IV., figs. 18—21).

*Flabellum pavoninum* Lesson, Illustr. de Zoologie, pl. 14 (1831), Ed. et H., Ann. des Sc., nat., 3e ser., t. IX., p. 260 (1848), and Cor., t. II., p. 80 (1857).

*Euphyllia pavonina* Dana, Zoophytes, p. 159, pl 6, fig. 6 (1846).

*Flabellum distinctum* Ed. et H., Ann. des Sc. nat., 3e ser., t. IX., p. 262 (1848) and Cor, t. II., p. 80 (1857); Duncan, Trans. Zoo. Soc., Lond., qto., p. 322, pl. XXXIX., figs. 1-13 (1871).

*Flabellum patens* et *australe*, Moseley, Challenger Report, pp. 172-3, pl. VI., figs. 4, 4a, 5, 5a and pl. VII., figs. 4, 4a, 5, 5a, 5b (1881).

*Flabellum paripavoninum* Alcock, Madreporaria, Calcutta Museum, qto., p. 21, pl. II., figs. 3, 3a, 3b (1898).

The collection obtained nine specimens of this species made up of (1) five from 6½ miles E. b. S. of Cape Natal, 54 fathoms, bottom "fine sand and algae"; (2) one 5½ miles S.E. ½ E. from the same, 62 fathoms, "sand, gravel and rock"; (3) one 9½ miles S.S.W. ¼ S. from Cape Vidal, 80-100 fathoms, "rocky" bottom; (4) one 9½ miles S.E. ¼ E. of O'Niel Peak, 90 fathoms, "broken shells"; and (5) Umhloti R. Mouth N.W. ½ W. 15½ miles, 100 fathoms, "sand, shell, hard ground."

The corallum of this species is characterised by its much compressed calicle with flattened, pointed ends. The mouth of the calicle in longitudinal section of its longer axis or as seen in side view varies from two-thirds to a full semi-circle, so that the two end wings make an angle of from 120° to 180° with one another. In the centre there is a short cylindrical pedicle, which only in the smallest specimen (long axis of calicle 13·5 mm.) still remains attached.

The measurements of eight of the specimens are as follows :—

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| I. Number of Specimen | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8[1] |
| II. ,, Dredging | 1 | 1 | 1 | 2 | 3 | 1 | 4 | 5 |
| III. Length of Calicle.. | 47* | 48 | 48 | 33 | 34 | 29 | 20 | 13·5 |
| IV. Breadth of do. .. | 21 | 22 | 22 | 12·5 | 14·5 | 12·5 | 9·5 | 6 |
| V. Height of do. .. | 34 | 37 | 36 | 25 | 24 | 25 | 17·5 | 10 |
| VI. Length of perpendicular from base of pedicle to line joining ends of calicle | 6·5 | 7 | 7·5 | 2·5 | 3 | 1·5 | 2 | 6 |
| VII. Septa fusing by trabeculae .. .. | 52† | 48 | 48† | 40 | 38 | 40 | 26 | 16 |
| VIII. Total Septa .. | 220+ | 212 | 100† | 152 | 160 | 152 | 104 | 58 |

The measurements in lines VI. and III. taken together give the angle, which the wings form with one another.

By comparison with Lesson's figure it will be seen that Nos. 1 and 2 are almost absolutely similar in shape. Dana figures two specimens, one with basal angle approaching two right angles, and a second resembling No. 3, 1 and 2 being intermediate. *F. distinctum* Ed. and H. differs in having cycles I.-III. equal in size, whereas *F. pavoninum* has cycles I.-IV. equal; the fusion of the septa by trabeculae is presumably the same in both cases. The septa of cycles III. and IV. can be easily distinguished in No. 2 and in Nos. 4 7 are very distinct. Yet at the same time cycles I. to IV. are "sensiblement égales." In No. 3 the distinction is much more pronounced and "les trois premiers cycles seulement sont égaux entre eux." Indeed, there is no difference between Edwards and Haime's two species. So far as Duncan's figures of *F. distinctum* are concerned, there is obviously no separation between his species and my specimens, some of which show the intermediate characters to *F. pavoninum*. The figures of the two species, however, present marked differences in the smoothness of the external epitheca, but Nos. 1 and 2 above resemble *F. pavoninum* in being quite smooth, while in the rest lines of growth and, in some cases, distinct ribs can be seen. (Figs. 18—21).

*F. patens* and *F. australe*, both Moseley, have, so far as I could see from an examination of the specimens, no specific differences from the species under consideration. No. 2 above shows a cutting away of the septal borders close to the margin of the calicle, a character not found in the other specimens from the same dredging. In the specimens enumerated it is

* Measurements in millimetres. † These numbers, being taken from spirit specimens, possibly slightly exceed those here recorded. [1] This specimen was brought up together with a large number of corallites of *F. rubrum*, its external resemblance to small specimens of which is at once apparent from the measurements.

clear that the number of septa increases markedly with the lengthening of the calicle. The larger number of septa—268 and 248—found in *F. australe* is undoubtedly due to the extra size and length of the calicle, 55 mm.

*F. paripavoninum* Alcock is apparently founded on a single specimen. It has a "sessile scar of attachment but no pedicle." No stress is laid on this point, and as all other forms of this shape have a pedicle, it must be regarded as purely accidental, until more specimens are discovered. For the rest its characters are not such as would not include it within the range of variation of this species.

The species, as above constituted, has been obtained from Singapore, China and Japan (Ed. and H.), Ki Islands, 129 *f.* (fathoms) and New South Wales 120 *f.* (Moseley), North Atlantic 994, 364 and 304 *f.* (Duncan), Laccadives 636 *f.* (Alcock) and Cape of Good Hope 50 to 100 *f.*

### 5. FLABELLUM RUBRUM. (Pl. IV., figs. 22-34).

*Turbinolia rubra* Q. et G., Voy. de l'Astrolabe, Zoophytes, p. 188, pl. 14, figs. 5-9 (1833).

*Flabellum rubrum, cumingii, elongatum, crassum, crenulatum elegans* et *profundum* all Edwards and Haime, Ann. des Sc. nat., 3e sér., t. IX., pp. 265-280, pl. 8 (1848) and Cor., t. II, pp. 89-97 (1857).

*Euphyllia spheniscus* Dana, Zoophytes, p. 160, pl. 6, fig. 1 (1846).

*Flabellum irregulare* Semper, Zeit. für wiss. Zool., Bd. XXII., pp. 242-5, pl. XVI., figs. 7-17 (1872).

*Flabellum transversale* Moseley, Challenger Report, p. 174, pl. VI., fig. 6, 6a (1881).

The collection contained over five hundred specimens of this species, made up as follows :—

| | Number of Specimens. | Depth. | Locality. | Character of Bottom. |
|---|---|---|---|---|
| 1. | 1 | 27 | Lat. 33° 50' S., long. 25° 54' 30" E. | Sand. |
| 2. | 6 | 30 | Lat. 33° 53' S., long. 25° 51' 20" E. | Mud, sand and specks. |
| 3. | 26 | 32 | Lat. 33° 3' S., long. 27° 57' E. | Sand, shell and rock. |
| 4. | 185 | 47 | Cape Natal W. b. N. 4½ miles | Sand and shell. |
| 5. | 258 | 54 | Cape Natal W. b. N. 6½ miles | Fine sand and algae. |
| 6. | 2 | 27 | Morewood Cove (Natal) NW b N ¾ N 3 miles | Sand and shell. Hard ground. |
| 7. | 11 | 100 | Umhloti R. Mouth N.W. ½ W 15½ miles | Sand and shell. Hard ground. |
| 8. | 35 | 40 | Off Umhloti R. Mouth | Sand and shell. Hard ground. |
| 9. | 5 | 90 | O'Neil Peak, N.W. ¼ W. 9½ miles | Broken shells. |
| 10. | 1 (dead) | 250 | Port Shepstone, N.W. b. W. 11 miles | Rock and coral. |
| 11. | 5 | 45 | Lat. 32° 53' S., Long. 28° 12' E. | Coralline material. |

# TABLE OF MEASUREMENTS, ETC., OF THE COLLECTION.

1. No. of specimens. 2. No of septa fusing by trabeculae. 3. Total number of septa. 4. Average breadth of calicle, when the length of the same measures—

| Numbers of the Dredgings. | Number of Specimens Examined. | 9-11·5 mm. | | | | 12-14·5 mm. | | | | 15-17·5 mm. | | | | 18-20·5 mm. | | | | 21-25 mm. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 5 | 60 | 4 | 15 | 56 | 5·9 | 26 | 20 | 73 | 7·6 | 22 | 21·1 | 77·2 | 8·6 | 7 | 23·1 | 85·1 | 9·1 | 1 | 24 | 100 | 9·5 |
| 4 | 82 | 12 | 15·1 | 55·8 | 5·6 | 32 | 19·2 | 69·8 | 7·1 | 31 | 20·4 | 77·6 | 8·1 | 7 | 21·1 | 78·6 | 8·7 | 0 | — | — | — |
| 8 | 16 | 4 | 13·5 | 53 | 5·5 | 9 | 19·7 | 66 | 7·3 | 3 | 20 | 72 | 8·8 | 0 | — | — | — | 0 | — | — | — |
| 1, 2 and 3* | 20* | 0 | — | — | — | 2 | 17 | 71 | 7 | 6 | 19 | 80·3 | 9·6 | 3 | 2 2 | 85 | 10·3 | 4 | 22 | 99 | 12·1 |
| Rest × | 20 | 2 | 14 | 48 | 4·5 | 10 | 18·9 | 63·2 | 7 9 | 4 | 20 | 68 | 8·3 | 3 | 21·3 | 73·3 | 10·3 | 1 | 24 | 84 | 10·5 |

× Comprises 3 obtained in a separate haul of 5, 2 of 6, 5 of 7, 5 of 9 and 5 of 11.

* Made up of 17 of 3, 2 of 2 and 1 of 1. Five of these are too large to be included in this list; their enumeration with length of calicle first in place of number of specimens is as follows:—26·5, 22, 102, 13; 27, 24, 100, 15; 28, 24, 102, 15; 33, 24, 140, 17; 37, 24, 168, 18.

The species, as may be seen from the accompanying table, is extremely variable, but its main characters would seem to be as follows :—

"Corallum conical or wedge-shaped, generally compressed, usually with a distinct scar below, 2 to 7 mm. in length and showing 12 to 24 septa. Sides of the corallum commonly with curved transverse bands, corresponding to intervals of growth, often at the narrow sides opposite the ends of the calicle carried out into small wings. Wings sometimes replaced by hollow root-like processes near the scar, perhaps also with additional roots at the sides; in large specimens wings generally absent. The calicle is elliptical, the top of the long axis not more than 1 to 3 mm. below that of the short. Relation of axes very variable, about 2 to 1.

"The centre of the calicle a deep fissure, the larger septa ending almost perpendicularly against it, filled in below by trabeculae in medium-sized specimens from 20 septa and in large from 24. In all free specimens septa of cycles I. to IV. present, cycles V. and VI. depending on the size of the individuals.

"Height of free corallites from 4-35 mm.; long axes of same from 9-37 mm."

The septa, as in most or all species of the genus, have radially set fine ledges with spines at intervals, and the larger against the axial fossa are often much broadened at their edges where the trabeculae come off.

Although there are only three specimens in the collection, which appear to be absolutely the same as *F. rubrum*, this name has the priority. All the young corallites are of course fixed. They break off generally when their calicles have attained a length in their long axes of about 9 mm., the free corallites being about 5 mm. high. Some, however, are attached considerably longer, the largest attaining a height of 23 mm. Three of the specimens could not ever have become free, the central stalk being still perfect and surrounded on all sides by rootlets, numbering 7, 8 and 8. One of the specimens is attached to a small piece of decaying serpulid tube, and a second to a mere fragment of coral. Both supports seems to have been free, and suggest a possible reason for the throwing down of extra rootlets. The edges of the septa of these specimens further do not show through the epitheca. The calicles of two are scarcely compressed, and these two, taken alone, would undoubtedly have been placed in the former genus *Rhizotrochus*. Each rootlet communicates with two interseptal spaces on opposite sides of a septum. The latter bisects the rootlet where it joins the large corallite, and thence continues into the rootlet for some distance as a ridge on its lower side.

The species of Edwards and Haime differ from one another mainly in the shape of the calicle, presence or absence of spines near scar of corallite and systems of septa. The first of these varies greatly in my specimens. The compression in some is very slight, the angle made by the two flattened sides with one another being from 15° to 60° or 70°. Taking the long axis as 100, the short axis varies in No. 5 from 44 to 66, in No. 4 from 37 to 71, and in No. 3 from 43 to 83.

The wings are at first hollow, but owing to deposition of corallum inside become more or less solid. They are quite distinct in 80 per cent. of Nos. 4 and 5. Sometimes they continue up evenly on both sides, but generally there are small wings only at the end of the accretion lines, which probably show periods of rest; the two sides are not usually by any means symmetrical. In the larger specimens they are not so clear, but still traces are commonly present near the basal scar. With growth, in some cases, there seems to have been a certain amount of solution of the epitheca outside and deposition of corallum within. The wings might by this means become blunt spines. This may be partially the case in Nos. 1, 2 and 3. Of these, two have clearly wings, four are rounded at their ends, and ten have at least a pair of spines near their basal scars. Five smaller specimens of other dredgings have also paired spines, not wings. Three of these are very small, and without the specimens of Nos. 1, 2 and 3 it would naturally have been stated, when the corallum was thought to be of endodermic origin, that spines are characteristic of young individuals.

The septa vary with age up to 168, the maximum found. No less than 105 out of 168 specimens recorded in the table had 20 fusing by trabeculae, thus corresponding to *F. irregulare* Semper. This, however, appears to be only a stage of growth as any of the septa of cycle III. may be among the four, which fail to fuse by their trabeculae. The two sides of the calicle do not necessarily correspond, and every possible variation is found, in one with 24 large septa, the number being made up by the enlargement of 2 septa of cycle IV. In the majority of cases with 20 large septa it is the two central side pairs of cycle III. that fail to fuse.

In some cases the horizontal upper edges of the septa rise above the upper edge of the epitheca, while usually they lie in the same plane. In No. 1 they rise above it, but in some specimens of No. 3 lie about 1·5 mm. below, the appearance being as if their edges had been shaved down near the borders of the calicle.

An examination of the type specimen of *F. transversale* Moseley showed that it belonged to the same species, being merely a single corallite that had not lost its stalk. *F. thouarsi*

Ed. and H. probably is merely another form with stalk still intact, but I have no specimen directly comparable. Septal cycles I. and II. are described as equal, the calicle being 25 mm. long by 16 mm. broad. One specimen of No. 3 similarly has only 12 septa fusing in the axial fossa, its calicle being 15 by 12·5 mm.

In the table of measurements, given above, it may be observed that Nos. 1, 2 and 3 differ from the rest far more than the latter do from one another. The corallites obtained in these dredgings were overgrown outside by Polyzoa, weed and barnacles right up to the edge of the calicle, while on the rest isolated serpulid tubes or small masses of *Polytrema* alone were found. In addition to differences in size* the corallum is denser and thicker† ; the calicles are more rounded at their ends, and there is a tendency to form spines rather than wings. Indeed the appearances are such as to point to these forms constituting a distinct local race or even a variety. Against this view most of these specimens show 7 to 9 accretion lines, while in Nos. 4 and 5 these number only 4 to 5.‡ These bands are so regular in different specimens that it is quite clear that they indicate periods of growth. These periods must be annual, as there are no changes in currents or other oceanic conditions in the region except such. Hence it is possible that the differences are due only to age, the polyps having started on different years, when the conditions were not quite the same. Again the conditions of the various habitats may have differed, and partially caused the variation. Only one specimen of these three dredgings has a young form attached to it. This has 12 septa, and differs in no respect from those of other dredgings.

The group placed by Ed. and H. under § AA and FFF, called by Semper *F. variabile*, appears to be connected with *F. rubrum* by individuals. Some of Semper's figures have wings and others spines. The scars of all are larger than in the same author's figures of *F. rubrum* (= *irregulare*). This is probably due to the corallites breaking off in different accretion bands. In the present collection five specimens are doubtful. Most specimens from the Maldives in my posses-

---

* The corallites of Nos. 7 and 9 are also markedly larger than those of Nos. 3, 4 and 8.

† This is perhaps due to the stimulation of the incrusting organisms. In one corallite there is a distinct ring where the latter began to overgrow the calicle, when a fresh growing period seems to have set in, allowing the polyp to resume its sway. In some corallites the epitheca has been broken, and healed or rebuilt. In these the new epitheca is generally thicker than the old.

‡ The severance of the corallite usually takes place in the thinner basal part of one of these bands, a series of punctures being formed round the corallite.

sion belong to *F. variabile**, but a few more nearly approach *F. rubrum*. In the anatomy of the polyps I can find no constant differences. Semper evidently found few intermediates, but such do exist, so that his second species appears to be only a variety. It should be noted that both of Semper's species of *Flabellum* and his species of *Blastotrochus* were all found in precisely the same habitat. The latter does not differ except in its so-called generic characters from the two *Flabellum*. I would hence suggest that here we have a case of three true varieties of a single species with extremely rare intermediates, living together in the same locality, breeding together, but yet the vast majority preserving their parent forms.†

The species, as above constituted, has been obtained from New Zealand (25 *f.*), Bass Straits (38 *f.*), Phillipines (6-10 *f.*), China, Singapore (2-3 *f.*) and Cape Colony (27-100 *f.*). *F. stokesi* (= *F. variabile* Semper), if regarded as a variety, gives in addition the Arafura Sea (28 and 49 *f.*) and Maldives (20-50 *f.*). In the British Museum I have seen a number of specimens of which six (close to Nos. 1, 2 and 3) were obtained by Captain Sir E. Belcher at the Cape of Good Hope. Of species doubtfully the same *F. thouarsi* comes from the Falkland Islands, and *F. braziliense* Pourtalés (Memoirs Mus. Comp. Zool. Harvard, vol. IV., p. 33) was founded on a single *dead* specimen from 40 *f.* off the Brazil coast.

## 6. GENERAL ANATOMY OF THE POLYPS OF *F. RUBRUM* (Figs. I. and II.).

**Polyp.**—The polyp is seated as it were in a cup, formed by the corallite. It lies completely inside the skeleton and does not extend down in any way on the outside of its walls, forming an edge-zone. In the expanded condition the polyp would rear itself for at least 5-6 mm. above the epitheca. The tentacles would then be set as in a solitary Actinian round the top of the mouth-disc in a broad, double band separated by the peristome from an elongated stomodoeum. The contracted polyp, however, does not rise above its skeletal wall.

---

* The proper name of this species or variety should be *stokesi*, as Moseley has suggested, or some other of Ed. and H.'s names proposed at the same time. Its synonyms would appear to be *F. oweni*, *aculeatum*, *spinosum*, *debile*, *sumatrense* and *candeanum*, all Ed. and H., and *F. variabile* Semper.

The only other living species of Ed. and H. not already dealt with is *F. compressum* (Lamarck), of which there can be little doubt *F. affine* and *F. bairdi*, both Ed. and H., are synonyms.

† Such varieties are common enough in other groups of the animal kingdom, but this is the first suggested case in Madreporaria, or, I believe, Coelenterata. The bringing together of the male and female elements is a passive act, so that it is a fair inference that the three varieties would breed together.

The tentacles, or the pores of the retracted tentacles, form a circlet half-way between the epitheca and the stomodoeum; and the peristome is irregularly contracted into ridges between the attachments of the mesenteries. The stomodoeum may be either extremely reduced or enormously enlarged, the former if the polyp has been slowly killed in spirit or chromic acid, the latter if more rapidly fixed in formalin. To a certain extent the appearance and size of the stomodoeum depends on the state of retraction of the tentacles, being much larger when the latter are but partially invaginated.

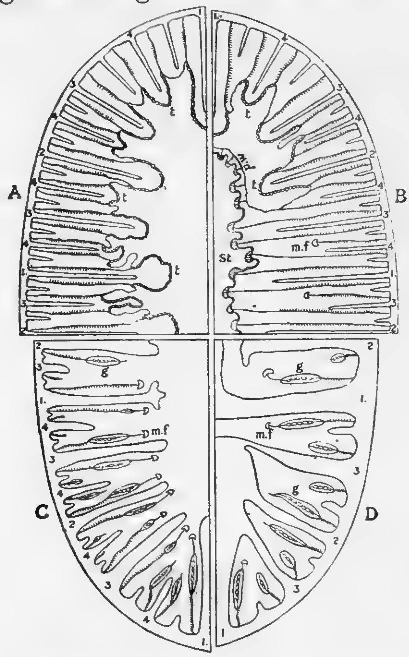



Fig. I. Partly diagrammatical transverse section through a single completely retracted specimen of *F. rubrum* in different planes:—A. Through the top of the epitheca a little below its edge: B. Through the stomodoeum, cutting the basal contracted ends of some of the tentacles: C. Through the top of the masses of generative organs: D. Through the bottom part of the generative organs.

The numerals refer to the cycles of the septa. *t.* Tentacles. *st.* Stomodoeum. *p.w.* Peristome wall. *m.f.* Mesenterial filaments. *g.* Testicular masses.

The sections were slightly simplified from camera lucida drawings. In addition to the general anatomy they show the decrease in size and disappearance of the mesenteries and septa lower down in the corallite. One of the mesenteries of a pair bounding a septum of cycle 4 reaches the stomodoeum (see B) and is so represented, although it is very unusual for such an one to do so.

**Septa and Mesenteries.**—When decalcified, the polyp is divided up into as many chief segments as there are larger septa. These are joined over the open mouth of the calicle by

the body-wall of the polyp, but are free below, where the septa fuse with one another. Each segment is further subdivided by the smaller septa, typically three in number. The septa throughout alternate with mesenteries. The latter are in pairs with their muscles—except on the directives—on the sides facing one another. It follows hence that half the septa are entocoelic and half exocoelic (Fig. I.). As already seen the orders of septa vary greatly in individuals, so that it is impossible to characterise any one order as exocoelic. From the alternate arrangement of mesenteries and septa it follows that the highest numerical order in any part is the exocoelic one. As the growth of any corallite proceeds, more and more septa up to six cycles appear. The former exocoelic order of septa becomes entocoelic by the development of new pairs of mesenteries. The increase of mesenteries takes place *pari passu* with the formation of new septa. An examination of 16 corallites has failed to reveal a single case of the growth of the new septa preceding that of the new mesenteries or *vice versa.* The mesenteries in every case are perfectly distinct on the external body-wall between the tentacles and the upper edge of the epitheca. The mesenterial filament is developed very shortly after the mesentery is formed, but the definite formation of the muscular fibres takes place later, and they gradually increase throughout life.

**Tentacles.**—The tentacles arise over the entocoelic septa alone, and are accordingly half as numerous as the whole body of septa. An inner cycle of larger tentacles, corresponding to the septa which reach the columella, and an outer cycle may usually be traced. The tentacles are retracted by the longitudinal muscles of the mesenteries in an acrecbolic manner (Fig. II.). The invagination is never complete, a central portion and two pockets on either side of the septum beneath being found. Secondary pockets also occur, the muscles seeming to be attached in clumps. A pair of mesenteries passes across towards the stomodoeum on each side of the base of a tentacle, some of their longitudinal muscles continuing a direct course up the tentacle. Below the outer cycles the mesenteries may to some degree extend into the tentacles, but with increase of size even in the expanded polyp come to pass around the base.

All the tentacles are covered with round, knobbed batteries of nematocysts, which gradually decrease in size from their tips. At the base these pass imperceptibly into the ectoderms of the external body wall and peristome, and except in the youngest tentacles do not cover over the attachments of the mesenteries.

**Stomodoeum.**—The stomodoeum is a slit, one-third to two-fifths of the long diameter of the calicle in length, with no

trace of any marked grooves at either end (Fig. I.). Its surface is owing to thickenings of its walls ridged over those mesenteries, which are attached to it. If 24 septa fuse in the axial fossa, there should be 48 mesenteries of a first order reaching the stomodoeum and corresponding to ridges. If a less number fuse, there should be a proportionately lesser number of mesenteries with ridges on the stomodoeum, but this is not so, three polyps with 18, 20 and 21 such septa having 48 mesenteries with ridges and one with 24 septa 50 such mesenteries. In a case with 20 septa (Fig. I.) two of the mesenteries out of pairs on each side of tertiary septa have failed to reach the stomodoeum, but their places have been taken by others bounding quaternary septa.

The lower edge of the stomodoeum is ill-defined and often in the contracted polyp somewhat turned outwards (Fig. II.). Its thickenings pass directly into the filaments of the corresponding mesenteries, which form a first order.

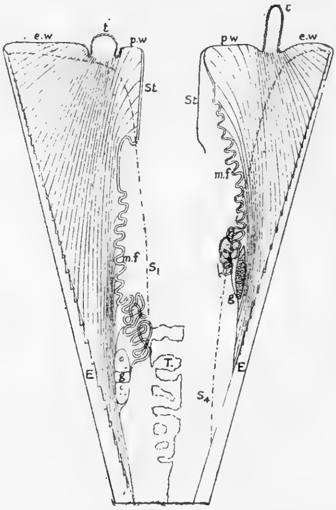



Fig II. Diagrammatical longitudinal section of a partially retracted specimen of *F. rubrum*, the left half cutting a tentacle over a primary septum, exposing the face of one of the bounding mesenteries, and the right half cutting a less retracted tentacle over a quaternary septum and likewise exposing the face of one of the bounding mesenteries.

The longitudinal lines on the faces of the mesenteries represent the distribution and course of the muscular fibres. Against the epitheca their attachment in clusters is, to some degree, shown.

*e. w.* External body wall. *t.* Tentacles. *p. w* Wall of the peristome. ***st.*** Stomodoeum. *m. f.* Mesenterial filaments. *g.* Generative organs (ovary on the left and testis on the right mesentery). *E.* Epitheca. *S* 1 and *S* 4 septa of cycles I. and IV., represented by incomplete lines. ***T.*** Trabeculae from the septal edge.

**Muscles.**—The muscles are of the usual Actinian type, but the circular sphincter is absent. The longitudinal muscular

fibres are set on plates of the structureless lamella, but the transverse, which are very slightly developed, have no such folds. The origin and course of the longitudinal muscles may be seen in Fig. II. The separate fibres never cross one another, but below the filaments muscle-plates are found on both sides of the mesentery, some of the most deeply attached muscles crossing the free edge of the mesentery to its opposite side. The fibres end at the attachment of the mesenteries more or less in clumps, which seem to be connected with a similar mode of attachment of the mesentery to the corallum (see Fig. II.).

The transverse muscular fibres, lying on the opposite faces of the mesenteries to the longitudinal, do not appear to me to extend more than half-way down the stomodoeum. They run outwards mainly to the body-wall external to the tentacles, and have no connection with the attachment of the mesenteries to the corallum. The tentacles being entocoelic cannot be connected with these muscles in any way.* The longitudinal muscles alone contract the polyp, the expansion being due to the elasticity of the polyp following the relaxation of the same muscles. The transverse muscles would seem to be present solely for the purpose of opening the stomodoeum for the reception of food, though they might, by drawing together the external body-wall and stomodoeum, assist slightly in pushing out the tentacles.

**Mesenteries.**—The first cycle of mesenteries—48 in number, all reaching the stomodoeum—should be the pairs on either sides of primary, secondary and tertiary septa. There are then typically 48 further mesenteries of a second order, 24 pairs on either side of quaternary septa. These do not reach the stomodoeum, but start from the peristome near the mouth, only very exceptionally being attached to the stomodoeum for the whole or part of its length. I have not cut serial sections of any polyp with a third cycle of mesenteries, but from dissections it is clear that the latter are attached almost in the same position as the secondary mesenteries.

The mesenteries vary considerably in size, but their general appearance may be seen in figures I. and II. In any polyp the secondary mesenteries are usually nearly of the same size, but the primary may vary somewhat, *in the smaller polyps* 24 being sometimes larger and extending deeper into the calicle marking out the original primary and secondary septa.

The filaments of the primary mesenteries extend down from the thickenings of the stomodoeum, and form an irregular

* The tentacles over the primary septa at each end of the calice, hence between the two pairs of directive mesenteries, are never contracted to the same extent as the lateral tentacles, being drawn in principally by the general contraction of the polyp.

series of loops down the edges of the mesenteries (Fig. II.). The character of looping depends on the state of retraction of the polyps, but normally alternates from side to side. Below they end in a massed series of larger loops, irregularly arranged. The end of the filament is not free. The mesentery between the massed portion of the filament and the longitudinal muscles is no doubt enormously extensile, but there is no part which could be shot out as an acontium (see Pl. III, fig. 17). The filaments of the secondary mesenteries commence right from their attachment to the stomodoeum or peristome, and, enlarging somewhat, extend down straight for some distance, still deeper forming similar loops.

**Generative Organs.**—The presence or absence in an individual of generative organs on any mesentery depends entirely and solely on its size. In the youngest male state single round or oval acini are found just behind or sometimes a little below the massed end of the mesenterial filament. In the next stage a few widely separated masses may be seen, forming with the thickened endoderm a narrow band. This increases in length and breadth, so that in the largest mesenteries an oval-shaped mass, 5 mm. long by 1·5 mm. broad, is found. The whole then consists of closely-packed spermagens, which vary considerably in size and shape, some being branched, others round or oval, and yet others nearly polygonal.

The ovaries are similar in size and position to the testes. In the ripe condition on the larger septa they have a row of up to about seven ova, the end ones oval in shape, the central one round, but all flattened where they touch one another. Fresh ova—at first small round bodies with no food yolk—generally appear in the structureless lamella each between a riper ovum and the free edge of the mesentery, but in one case, where the central of three nearly ripe ova seems to have been dehisced, three small ova have appeared in its place.

In 11 polyps of dredging No. 4 and 3 of No. 5 that I have examined the whole or main bulk of the mass is testicular on the primary mesenteries. On all the secondary mesenteries, where the development may be traced, the whole is always so. In one series of sections across a polyp of No. 4 (calicle 17 mm. long) I have found in the inner part of the testicular masses on the primary mesenteries a few relatively small isolated ova without food yolk. In one mesentery of a still larger polyp of the same dredging there are three ova on the inner edge of the testicular mass at its top end behind the massed loops of the mesenterial filament (Pl. III, fig. 17) and in all the other primary mesenteries of the same polyp ova were found as well. In two small polyps of No. 3 the mass is

testicular, and in two larger polyps (calicle about 23 mm. long, entirely formed of ova.

I had not sufficient examples of larger sized corallites as obtained in dredging No. 3, which I could decalcify so as to trace the changes in generative organs with increase of size. I am, however, impelled to consider that there must be protandry. The polyp first produces testicular elements, which are replaced as it grows by ova; a regular crop of these are then ripened. With increase of size the rate of growth of the corallite seems to gradually lessen. This is correlated with the production of ova, the increase in the number of which causes cessation of growth and finally the death of the parent polyp*.

**Note on** F. PAVONINUM.—I have only been able to afford to use one polyp between Nos. 6 and 7 of the table of measurements on p. 124 for the study of the anatomy of this species. Tentacles are present over all the septa, and the latter are all entocoelic, there being thus relatively twice as many mesenteries as in *F. rubrum*. Those pairs of mesenteries, which lie on either side of the septa fusing by trabeculae in the axial fossa, alone appear as a rule to depend from the stomodoeum.

In all other respects the anatomy is the same as above described in *F. rubrum*. The polyp is in the male condition. The spermagens are tightly packed together, and present in side view a round to branched appearance.

## 7. MINUTE ANATOMY OF THE POLYPS OF *F. RUBRUM*. (Pl. I and II, figs. 1—9).

**Calicoblastic Ectoderm** (figs. 1-3).—The layer of ectoderm separating the polyp from the corallum is everywhere complete, and even in the most roughly decalcified specimens is not torn away. It varies considerably in accordance as it may be in any position an active secretory layer or not. No definite cells can in any part be distinguished. Over the greater part of the corallum it is an extremely thin, finely granular layer, slightly thickened where nuclei are present. The latter are generally slightly oval in shape with granules but seldom a network. It only differs from the same layer in other corals in being better defined and more definite.

Near the base of the polyp and on the sides of the septa the calicoblastic layer simulates the appearance of a pavement epithelium, nuclei joined together by finely granular

* Since the above was written I have examined a large number of specimens of the same Coral from other localities. *Vide* "Some Notes on Variation and Protandry in *Flabellum rubrum* and senescence in the same and other Corals." *Proc. Camb. Phil. Soc.*, vol. XI, pp. 463-71 (1902).

protoplasm (fig. 3). As the edges of the septa are approached the layer thickens. Nuclei become more frequent, and tend to exhibit a definite network. The protoplasm forms, as it were, two layers, the one against the structureless lamella, the other with a ragged edge against the corallum, joined by a series of bridges between large vacuoles. The nuclei commonly lie in the outer layer or in these bridges (fig. 1). At the edge of the septum the ectoderm is still thicker, but the large vacuoles are nearly absent, and towards the outer side (*i.e.*, against the septum) the protoplasm is almost hyaline. The same, too, is the case at the upper edge of the epitheca, where the ectoderm forms practically a thick hyaline pad, seated on the corallum.

The calicoblastic ectoderm is also thickened greatly, where the mesenteries are attached to the corallum and on each side of the same (fig. 2). Its edge against the corallum is very ill-defined, indeed ragged and broken. The protoplasm is densely granular, often with relatively large granules. The processes which attach the structureless lamella to the corallum (desmocytes) do not materially differ from what Bourne, Fowler and others have described. They are especially well developed at the attachments of the mesenteries (fig. 2), but may occur in any part, small bunches being in particular scattered over the septal sides. Their development was quite clear, and did not differ materially from Bourne's description.[1] The first appearance of any *desmocyte* could be seen in a granular mass of protoplasm against the corallum, to which from the first it seemed to be attached. Subsequently by growth inwards it joins the structureless lamella, which may be thickened so as to meet it. At its base or side is always a nucleus with a well-defined network, but otherwise the same as those of the layer.

My researches add little to Bourne's most admirable and lucid account of the formation of the skeleton. There are no "scales,"[2] nor is there any indication of the possible formation and shedding of any such. The appearance of the layer in a few preparations of both hard and soft parts only showed that the structure in the decalcified sections had in no way changed. The layer had in all cases become slightly separated from the corallum—perhaps by killing—except where the desmocytes attached themselves.

The thickening of the ectoderm on the septal edges was found everywhere, but it varied enormously, at intervals being extremely thick and much more hyaline. Where secretion

---

1. *Quart., Jour. Micro. Sci.*, vol. 41, pp. 499-547 (1899).
2. *Vide* "Microscopic and Systematic Study of Madreporarian Types of Corals," by Maria M. Ogilvie, *Phil. Trans. R.S.*, vol. CLXXXVII., p. 83 (1896).

may be supposed to be going on especially actively, the layer is more hyaline and where not granular. The distances between the thickenings of the ectoderm on the septal edges correspond more or less to the distances between the ridges on the sides of the septa, and seem to lie over their ends. They would hence fall on the so-called "centres of calcification." When I first examined microscopically the skeletons of corals, I thought that these centres corresponded to the tubes of boring organisms, which became densely packed with the dust caused by grinding. Such organisms do tend in colonial reef-corals to bore along these centres, indicating perhaps that they are lines of least resistance. May not these centres be directly due to the thickenings of the calicoblastic layer? I can only regard the layer as an enormous syncitium, and for the growth of a septum there would seem to be a flowing up of the protoplasm on either side. Where the two layers of protoplasm fuse, *i.e.*, immediately over the "dark line" joining the "centres of calcification" there is an extensive formation of corallum. This takes on the crystalline form, but the regular arrangement is not seen until after the formation of the "growth lamellae" of the septal sides. The "centres of calcification" would, on this view, represent aggregations of crystals of carbonate of lime not arranged in any determinate direction. The radiations from these would then represent lines of irregularly arranged crystallisation.

**General Ectoderm** (figs. 4-8).—The ectoderm is everywhere extremely well preserved and shows its structure admirably. It varies in different polyps only in accordance with their state of contraction, outside the tentacles often appearing as if knobbed (fig. 4). Cell outlines cannot usually be distinguished, but it is an epithelium of a narrow, elongated, columnar facies with a broad, crowded layer of rod, or oval-shaped, densely granular nuclei. The latter vary considerably with the amount of vacuolation and the presence or absence of gland cells, but are for the most part found in the outer half of the epithelium. The outer or free edge presents an appearance of longitudinal striation, so that it is probably in life ciliated all over. Over the structureless lamella the protoplasm forms a finely granular network, in or above which a few rounder nuclei may be distinguished. These belong to irregularly-shaped sense cells, some of which are represented in the figures.

Gland cells occur of two kinds, mucous and granular, and can be best distinguished in tissues stained with thionin and orange green. The mucous cells stain deep blue, and the granular in accordance with their ripeness from yellow to black. The mucous cells are of the typical goblet-shape, and are situated in the outer half of the layer. Most of the

granular cells lie on the contrary in the inner half of the epithelium below its layer of nuclei; but many have definite necks extending through the epithelium to the exterior. While the oval-shaped nuclei of the mucous cells are situated at the base of their secreted mass, the nuclei of the granular cells lie in the middle, and are generally round with well-defined membranes and a few granules. In the earliest state the cells stain of a homogeneous yellow colour. Fine granules appear in this and give rise to larger spherules or masses. These become concentrated towards the outer part of the cell, which then sends a process to the exterior. At the same time the granules become more and more deeply stained and smaller (figs. 4-8).

**The Ectoderm of the External Body Wall** (fig. 4) is rather more vacuolar than the same layer elsewhere and slightly thinner. Granular cells are relatively rare and generally appear ripe. The basal nervous layer is usually distinct, and presents the punctate arrangement of the Actiniaria. Nerve cells are here and there present. A few nematocysts of the regular tentacular kind, but always much smaller, occur in places.

The **ectoderm of the tentacles** (fig. 5) differs only in being packed with the nematocysts in batteries. Mucous cells are less common than elsewhere, and granular cells about as numerous as in the ectoderm of the external body-wall. The nervous layer is concentrated under the batteries, three or four of its nuclei being often visible in a single section through the middle of a battery. No definite muscles can be distinguished, but the epithelium appears to give off processes which are joined to special attachments of the structureless membrane.

The nematocysts are the same as I found in the tentacles of *Coenopsammia* (Willey's Zoo. Results, p. 368). Each has about 30 turns of the thread, which in the fully ripe body lies immediately under its external wall, so that it projects spirally. The development of the thread follows the same lines as in *Coenopsammia*, the reduction in size taking place *pari passu* with the formation of the thread.

The **ectoderm of the peristome** differs only from that of the external body-wall in being less vacuolated and having the nuclei still more massed together. The nervous layer is always distinct, and the granular gland cells are fairly common. Nematocysts are not found.

The **stomodoeal ectoderm** (figs. 6 and 7) exhibits the same structure as that of the peristome. It is thickened over the attachments of the mesenteries (fig. 6), but between these is not so thick as on the peristome. In the latter position the nuclei form a broad line broken only where the

gland cells project towards the exterior. The nervous layer is little marked. Over the mesenteries (fig. 6) the appearance is as if the whole had been pressed together to give the enhanced thickness. The rod-shaped nuclei of the layer are closely packed together. The whole is evidently densely ciliated. The outer part is set with large mucous cells, and granular cells extend up from the base. These latter cells are very numerous and lie internally to the layer of nuclei, and, unless actively secreting, do not seem to have processes to the exterior. At the base they are connected by protoplasmic strands to the nerve layer, and in some sections appear to be connected with the protoplasm immediately around definite nervous nuclei. It is characteristic of these gland cells in this and the next part of the ectoderm to be considered that they usually have their nuclei quite distinct—more or less round with a few granules—and exhibit all phases from rest to active secretion.

The **mesenterial filaments** (fig. 8) are presumably ectodermic in origin, as they certainly are in structure. They are of the usual form, a central rounded part (the filament proper) set on the somewhat broadened end of the structureless lamella. The thickenings of the stomodoeal ectoderm gradually narrow as they pass into the filaments. Allowing for their necessarily constricted base the latter differ in no respect from these thickenings. They have the same thickness, the same gland cells and nuclei, the nervous layer alone perhaps not being so well marked. They also seem to be ciliated. On the straight upper edge of the mesentery gland cells are not so numerous, and the nuclei are very dense. In the central half the whole of the inner part is crowded with granular gland cells, while towards the lower end the filament is more vacuolated.

**Endoderm** (figs. 2, 3, 7 and 8).—Generally cell outlines could not be distinguished in the endoderm, but in some sections near the attachment of mesenteries the protoplasmic areas had become partially separated from one another. In this position (fig. 2) the layer consisted of low columnar cells with large, flattened, basal processes, spreading outwards on the structureless lamella. Their nuclei were nearly round with well-defined membranes and network. Between the cells were a number of large vacuoles, but in this position no glands of any sort could be distinguished.

More often, except where especially thickened, the endoderm appears to consist of a vacuolated epithelium of more cubical facies with slightly oval nuclei (fig. 7). In certain positions, where the body-wall immediately overlies the corallum, it is thinner and more homogeneous. On the sides of the mesenteries and under the peristome and tentacles it is

thicker and more vacuolated, and in the latter position the cells appear to be directly attached to low processes of the structureless lamella. Over the muscles the layer is thicker with more oval nuclei (fig. 2).

Under the mesenterial filaments the endoderm is as it were concentrated to form two great pads to support the filament, generally as broad or broader than the filament itself (fig. 8). These are formed of granular protoplasm scattered with the regular endodermic nuclei, and with small, round, deeply staining granules, appearing almost like nuclei of a second order. There is here little vacuolation and no definite contour against the coelenteron, the edge being drawn out into ragged processes. In this position, though indeed they may be found sparsely distributed over the whole endoderm, are a few mucous cells of small size and a large number of round homogeneously staining bodies of about twice the diameter of the nuclei. The latter take up all stains fairly evenly, and exhibit no trace of structure. When teased out they appear as round refractive bodies, and are, I have no doubt, of a fatty nature. In the same position at the base of the filament I have also found diatoms and other algal matter inthe endoderm.

A number of oval bodies generally occur in the endoderm on each side of the upper top ends of the septa, forming almost a layer (fig. 3). In a polyp with calicle 17 mm. long they are only present in this position, but in smaller polyps isolated ones are found anywhere over the corallum. They generally do not stain, or stain very imperfectly, and appear in section to have a number of pieces of a thick filament. When reconstructed, a spirally coiled thick thread is found (fig. 9). The various coils, about 12 to 15, are in contact, and extend diagonally around the whole. The appearance approaches that of the mesenterial nematocysts of *Cocnopsammia* (*loc. cit.*, p. 370), but with enormously swollen threads and no discharging apparatus. Most are in the same condition as in the figures, but I have found a few with as yet no thread developed. Some have no nuclei, but where present they are oval and densely granular. There are no indications of any having been ejected, nor of any possibility of ejection. There can, however, be no doubt, but that they are nematocysts, perhaps rudimentary or reduced. As such their position, especially on the upper free edges of the septa, is probably not devoid of morphological significance.

**Generative Organs.**—In the young stage the testes are composed of small cell masses, forming follicles in the structureless lamella. Later, as described by Hickson in Alcyonium,* each follicle consists of a dense mass of granular nuclei surrounding a small open central coagulum.

* *Quart. Jour. Micr. Sci.*, vol. 37, p. 343 (1895).

The ova have a large round nucleus with nucleolus set in a mass of yolk spherules, the whole sometimes reaching 1·5 mm. in length by nearly 1 mm. in breadth. The nucleus is usually situated in the upper part of the cell, and in a fortunate series of sections I found near the base of two ova small canals extending through the endoderm. These open from the exocoelic side, and reach down to the surface of the ova, one of which seems to have partially flowed into its canal. The diameter of the canals is in each case about that of a human, red blood-corpuscle, and the sections, which are not quite so thick, appear in both cases to have been cut almost longitudinally through the centre of each channel. The bounding endoderm shows longitudinal striae in the walls, but the existence of canals is quite clear under a high power. Although I have examined many other ova I have not found these oviducts elsewhere, and I suspect that they are merely temporary structures for the escape of the ova. They have not been previously described, so far as I am aware, in the Madreporaria, and are almost certainly what the Hertwigs described as the "Fadenappart" of the ova in the Actimaria *

The single polyp of *F. pavoninum*, that I examined, is in rather a different condition, so far as digestion is concerned, to any of those of the above species that I have worked over. It, however, only differs in its minute anatomy from *F. rubrum* in that mucous gland cells are more conspicuous and numerous both in the ectoderm, and more especially in the endoderm.

## 8. ON THE POST-LARVAL DEVELOPMENT OF *F. RUBRUM.* (Pl. III, figs. 10-16.)

**Dried Coralla.**—The corallites of dredgings 4 and 5 in particular have various stages of the development of the species growing upon them. In the earliest stage found there is a distinct round basal plate with 6 septa radiating from the centre, but not meeting one another. There is no trace of epitheca. As yet it is uncertain whether the young corallite belongs to *Flabellum* or to a fungid coral, which I have also found growing on some of the specimens. The earliest undoubted stage is that of a corallite, nearly 2 mm. in diameter, with a distinct epithecal rim, ·2-·4 mm. high, and 6 primary and 6 secondary septa (fig. 10). Another, almost similar, has the epitheca ·5 mm. high showing the

* *Die Actinien* [1879].—Plate vii., Fig. 13, very closely resembles the appearance I found, but the membrane of the ovum in my section is distinct and the nucleus at the opposite end of the cell (Fig. 2).

early growth lines; the diameter is 2 mm., and the septa are practically the same as in the previous stage (fig. 11). A third is 1·5 mm. high with a very marked looping outwards of the epitheca between the septa, of which the primaries extend further into the corallite.

In fig. 12 is represented a stage where the primary septa are beginning to give off trabeculae; the specimen is 1·75 mm. high and 2·5 mm in diameter, and has well-marked growth-lines on its epitheca. In fig. 13, a specimen 1·5 mm. high by 2 mm. in diameter, the primary septa have all fused with one another by trabeculae, but as yet there are no signs of any tertiary septa. The latter have appeared in the next stage (fig. 14a) 4 mm. high by 3·5 mm. in diameter. The calicle has begun to elongate the terminal septa of its long axis belonging to the first cycle. The six primaries are still distinctly the larger, but six secondaries have fused with them and with one another. The corallite in side view (fig. 14b) shows marked accretion lines and the characteristic wavy structure of the epitheca. The former represent slight additions to the epitheca, and do not correspond to the lines of growth in the older specimens, which are markedly larger and consist of many such.

The further changes lie in the gradual fusion of the tertiary septa to those of cycles I. and II. by trabeculae. This does not take place generally until there has been a very marked and considerable increase in the size of the corallite, nor usually until after it has become free. Fig. 15 represents a free specimen 6 mm. high, 9·5 mm. long axis of calicle, and 4·5 mm. short axis of same. Only one septum of cycle III. has as yet become fused with those of I. and II. This is situated in an end space between septa of cycles I. and II., and it will be noticed that the tertiary septa in these four spaces are larger than in the side ones, being indeed the first to fuse. Those in the next four spaces are larger than those in the central ones, which are naturally from the method of growth of the corallum the last to join up, only indeed fusing in the largest corallites. In the figure it may be observed that in two of the end spaces of the calicle between septa of cycles I. and III. quinary septa have appeared on either side of the quaternary, which are everywhere complete.

The corallum, where it breaks off from its pedicle, varies considerable, but is usually in the stage with 12 septa fusing with only traces of the tertiary septa (fig. 16). A series of perforations appear right round the corallite in one of the accretion bands near the base, but what causes these I have been quite unable to determine. In no case is there any

regeneration from the still attached stalk as in *Fungia*, *Cycloseris** and probably many other genera.

**Polyps** —(Text-Figures III. and IV.).—The greater part of the collection was forwarded to me in formalin. For the determination of the species it was necessary to dry and clean a considerable number of the adult specimens. To study the development of the septa and corallum I had to do the same to some of the smaller forms. The earliest of these with 6 large and 6 small septa appeared, as if the tissues of the polyp had been torn off the mouth of the calicle.† All the specimens of the young forms seemed to have suffered greatly, and I rejected one after another as useless for section cutting, placing them in the cleaning bath. Finally I selected a young polyp, which from surface view appeared to have been torn around the base of the tentacles where they run into the external body wall, there being no visible trace of tentacles, peristome or stomodoeum. The central part of the calicle was filled in with a mass of the irregularly coiled mesenterial filaments, which I hoped might show the structure. On cutting a series of transverse sections the whole polyp turned out to be thoroughly well-preserved. So far as I can see, there is no trace whatever in the polyp of any rupture or tearing off of any part of the body wall, beyond what is clearly due to the perforation of the latter by the upper, sharp edges of some of the septa.

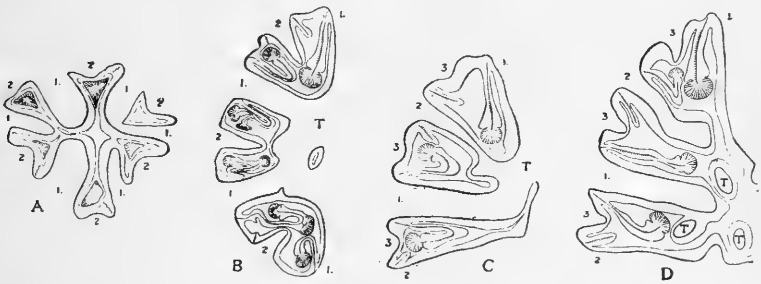



Fig. III. Transverse sections through the attached post-larval stage of *F. rubrum*, described in the text, in four different planes, shown approximately in Fig. IV. (drawn under the camera lucida).

A. shows the connection of the cavities of the different systems at the base of the polyp. Only traces of mesenteries are present by three of the septa. B. represents half the same at a higher level. The primary septa alone fuse in the axial fossa. The first 12 mesenteries are complete and the second 12 have commenced. C. and D. represent the same quadrant, C. where the primary and secondary septa both fuse by trabeculae and D. a little higher.

The numerals refer to the cycles of the septa. *T.* Trabeculae from the septal edges.

---

* *Vide Willey's Zoological Results*, pp. 171-180 and plates XIX and XX.

† Two other specimens, since found, corroborate the development as described in the following pages. They are both of a considerably earlier stage.

The general structure of the polyp may be best seen by reference to Figs. III. and IV. The corallite has 12 septa fusing by trabeculae in the axial fossa, the septa of cycles I. and II., alternating with the 12 septa of cycle III., which are extremely small, only just having made their appearance. The stage then is about that shown in fig. 14. The mesenteries number 24, 6 pairs of larger situated on either side of the primary septa and 6 pairs of smaller against the secondary septa. The filaments of the former mesenteries form great bunches of coiled loops, but of the latter are very slightly developed (Fig. IV.) In one or two of the exocoeles traces of the tertiary mesenteries are found in prolongations of the structureless lamella, which have as yet no trace of filaments.

All the mesenteries are attached above to the body wall, which forms a rim around the mouth of the corallite of about one-fifth its breadth. The mesenteries hang from this, their free edges being continuous with its edge (Fig. IV.), but their filaments do not appear until some little distance below the same. On the larger mesenteries the muscular filaments have developed in the typical manner, most originating near the edge of the body-wall; on the smaller mesenteries they are as yet scarcely noticeable. *There is no trace of any tentacles in any area of the body-wall, having nematocysts or otherwise, nor of any stomodoeum.*

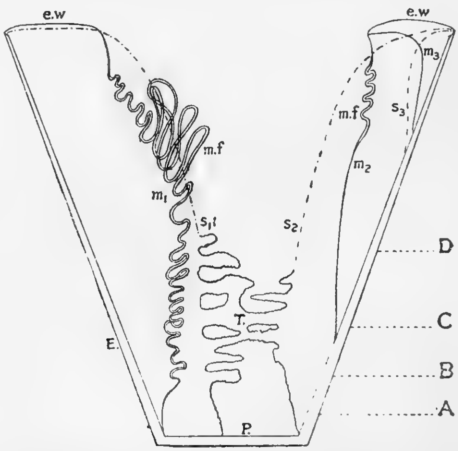



Fig. IV. Diagrammatical longitudinal section through the attached post-larval stage of *F. rubrum* described in the text. The left side represents one of the mesenteries bounding a primary septum, and on the right side mesenteries bounding secondary and tertiary septa are shown.

A.—D. sections shown in Fig. III.

*e. w.* External body-wall. *m. f.* Mesenterial filaments. $m_1$, $m_2$ and $m_3$. Mesenteries bounding septal cycles I., II. and III. $S_1$, $S_2$ and $S_3$. Septa of cycles I., II. and III., represented by incomplete lines. *T.* Trabeculae from the septal edges. *E.* Epitheca. *P.* Basal plate.

As the series of sections show (Fig. III.), the primary and secondary septa fuse with one another by their edges, so as to close in the axial fossa at a certain depth with a mass of trabeculae (Fig. III. C.). Lower down the secondary septa become smaller, and the fossa is closed in by processes from the primary septa alone (Fig. III. B.). Indeed the latter processes form almost a solid mass closing in the axial fossa. Still lower, the primary septa themselves become reduced so that the axial fossa is quite open (Fig. III. A.). The tissues of the different segments between the primary septa fuse across, and place the whole coelenteron in free communication. In the lower half of the polyp the coelenteron is, however, much reduced—in many places almost obliterated—by the convolutions of the mesenterial filaments.

Besides the above points, the bearing of which will be considered later, there is little to note about the polyp. The enormous thickness of the body-wall, as seen in the camera lucida drawings (Fig. III.), is due to the relatively great thickness everywhere of the endoderm. The layer is coarsely granular, and somewhat similar to the same layer at the base of the mesenterial filaments in the adult (p. 142, and fig. 8); cell outlines may, however, be distinguished in some places at the free edge of the layer. Fat cells are present here and there, and foreign bodies (principally algal) are found near the bases of the mesenterial filaments, showing that the polyp has been actively feeding even in its present condition. The typical aborted nematocysts of the adult endoderm (p. 142 and figs. 3 and 9) may be found anywhere, but occur mainly near the septal edges. They only differ in being somewhat smaller than in the adult. On the sides of the mesenteries the endoderm only differs in being thicker and more granular. The flattened plates of the structureless lamella have but commenced to form. The muscular fibres are as yet more or less isolated from one another, except at the base of the polyp, and do not form the characteristic square blocks usually seen in a transverse section.

The mesenterial filaments are of the same structure as in the adult, but rather more granular. The structureless lamella is extremely thin, in many places scarcely existing as a distinct layer.

The calicoblastic ectoderm varies from a columnar to a cubical facies, and is everywhere a well-defined hyaline layer with little or no granulation. The "desmocytes," except at the base of the polyp, are not yet attached to the structureless membrane. The whole layer is noticeable for its hyaline appearance and well-defined edge against the corallum, never having a ragged surface except near the attachments of the mesenteries. Above the corallum the

calicoblastic ectoderm merges gradually into the external ectoderm, which only differs from that of the adult in being less vacuolated and in the comparative absence of mucous and granular gland cells.

A later stage, which I have also examined by serial sections, is that of a still attached polyp, long axis of calicle 5 mm., and short axis 2·5 mm. It has 48 septa, of which 12 alone fuse in the axial fossa, the stage being hence a little earlier than fig. 15. The stomodoem is an extremely shallow invagination. There is as yet no trace of generative organs, the polyp being otherwise, even in its minute anatomy, similar to the adult. The tissues surrounding the septa fuse across below the mass of trabeculae in the axial fossa, thus extending to the very bottom of the corallite. The minute examination has shown no cause which can in any way produce the breaking-off of the calicle from its stalk. Some of the tissues would undoubtedly seem to remain in the pedicle, but, as already mentioned, I have found no evidence of its possible future growth to form a fresh corallite.

## 9. CONCLUSIONS RELATING TO THE GENUS *FLABELLUM.*

In the preceding pages an attempt has been made to investigate and determine as far as possible the variation in the skeleton of two very dissimilar species of the genus *Flabellum*. The variation is of two kinds, specific and normal.* The latter may be best seen by reference to the synonomy. It is in these two species enormous, and the study affords some data for considering the possible and probable variations not only in the same but in other genera. In *F. rubrum* there appear to be three distinct specific or discontinuous variations, between which the intermediates do not form more than 1·2 per cent. of the total number of specimens. This, so far as I am aware, is the first suggestion of the presence of distinct varieties in the Madreporaria.

The question as to whether the skeleton in the axial fossa represents a true columella, built by deposition on the basal plate, or is merely formed by trabeculae from the septal edges appears to me of morphological and generic importance. The development shows clearly that there is no such true columella in *Flabellum*.† Trabeculae

* See "Heredity, Differentiation and other Conceptions of Biology," by W. Bateson, *Proc. R. Soc*, vol. 69, p. 193.

† In this connection it is interesting to note that series of sections of even moderate sized attached corallites show at different heights the development of the septa equally as well as separate corallites in different stages. There is in *F. rubrum* no obliteration of the axial fossa by corallum between the earliest trabeculae that arise and the basal plate.

are merely formed by the fusion across the axial fossa of the body-wall, covering the septal edges, and may arise in any corallite of any genus. The origin of rootlets has been clearly shown by Lacaze Duthiers* in *F. anthophyllum*. They seem to arise as a flowing over the edge of the cup of the tissues of its polyp, probably brought about by the absence of favourable circumstances for the deposition of the skeleton and the presence of more suitable conditions for the increase of the polyp itself. These considerations lead to the absorption of the genus *Rhizotrochus*, while the close resemblance between the buds of *Blastotrochus* and *Flabellum* scarcely allow of their being distinct genera.

The comparison of the anatomy of the polyps of *F. pavoninum* and *F. rubrum* show that they are separated by the fact that all the septa in the former are entocoelic and have tentacles over them, whereas half the septa of the latter are exocoelic, with no correspondingly situated tentacles. The mesenteries of the former are hence twice as numerous as the septa, and of the latter the same in number.

Moseley's account† of the anatomy of the genus is rather confused. A generalised transverse section, Moseley's fig. 10 shows twice as many mesenteries as there are septa in the genus, and it is stated that there are the same number of tentacles as there are septa. This, as a generic character, is contradicted by the same author's fig. 12 of *F. japonicum*, which shows 48 tentacles corresponding to septal cycles I.—IV., while cycle V. is also stated to be present. From this figure the presumption is that the septa and mesenteries alternate in this species as in *F. rubrum*. A figure of a longitudinal section of *F. alabastrum* shows three orders of mesenteries, attached (1) to the lower edge of the stomodoeum, (2) to the junction of stomodoeum and peristome, and (3) to the peristome near the bases of the tentacles, an arrangement similar to that found in both *F. rubrum* and *F. pavoninum*. The ova occur on all the mesenteries according to size, but are not represented in any determinate series, being scattered all over the lower parts of the mesenteries.

In *F. anthophyllum*, according to Lacaze Duthiers (*loc. cit.*), the tentacles and septa correspond in number. The mesenteries likewise are of the same number, and the arrangement accordingly is such that half the septa and tentacles are exocoelic. The testes consist of polyhedral masses, and the ovaries each of 4-5 ova placed in a row, a similar arrangement to *F. rubrum*.

---

* "Evolution du Polypier du *Flabellum anthophyllum*," *Arch. de Zool. exp. et gén.*, 3e ser., t II., p. 445 et seq. (1894).

† Challenger Report on Corals, pp. 162-4, pl. xvi., figs. 10-12 (1882).

In his description of *F. patagonichum* Fowler* has woefully confused theca and epitheca, and septal trabeculae with columella. There are 4 orders of septa, all entocoelic and with tentacles. Mesenteries I. and II. (on either side of septa I. and II.) are alone attached to the stomodoeum, while in *F. rubrum* and *F. pavoninum* I.-III. are so attached. The stomodoeum is stated to have well marked gonidial grooves and "Through periphery of mouth-disc (peristome) protrude the acontia" through "definite openings." †

The above short *resumé* of our present knowledge of the anatomy of the polyps shows that the differences in the corallites are correlated with differences in the polyps. For a thoroughly scientific classification a knowledge of the polyp anatomy is essential. In the case of *F. rubrum* it confirms the diagnosis of the species and its variations, which was first studied on the dried coralla alone. If there is so much specific variability in the polyps of one genus as implied by the above, why not in all genera. Of the specifically variable polyp characters I would only draw further attention to the number of mesenteries meeting the stomodoeum and depending from it. My experience in *F. rubrum* is that this character is much less variable than any founded on numbers of septa of different sizes, etc. Indeed, it seems to me to be probably one likely to be of no inconsiderable value for separating our species from one another.

The importance of the development of the corallite lies in the fact that the regular 6-system radial arrangement of septa is found dominating the early stages, whereas with growth the calicle becomes elongated, bilaterally symmetrical with 20—24 equal septa. However the mesenteries may develop, the septa in all genera of Madreporaria support Milne-Edwards and Haime's views on radial symmetry being primitive in the group; that in effect the group was evolved from forms with pronounced radial symmetry.

The minute anatomy in different polyps varies enormously in accordance with the state of the polyp so far as feeding is concerned. In one polyp I found large numbers of a Foraminiferan, which Mr. J. J. Lister has referred to the genus

* "The Anatomy of the Madreporaria," *Quart. Jour. Micro. Sci.*, vol. XXV., p. 577, pl. XL. (1885.)

† Fowler's description of anatomical details is meagre and the figures are diagrammatical. According to Fowler's account there are a few points of difference from *F. rubrum*. The mesenterial filaments are said to be found on the whole free edges of the mesenteries, even below where the ova are situated and the acontia given off. The oblique exccoelic muscles of the mesenteries—presumably traversing the structureless lamella—become (according to Fowler) the external longitudinal coat of the tentacles, and the longitudinal muscles of the mesenteries the circular fibres of the same. The acontia are said to be set with both tentacular and mesenterial nematocysts, while Fowler's figure of the section of one is peculiar in only showing a single thread-cell.

*Operculina*, and in others quantities of diatoms and algal growths. Where such are present the stomodoeal epithelium and the mesenterial filaments are reduced in size, the granular gland cells having sunk down, after secretion, towards the structureless lamella, and not showing the swollen out appearance seen in the figures. Every stage of ingestion and protusion of foreign matter could be seen in the swollen out endodermal bases of the mesenterial filaments, but elsewhere was not observed. The storing up of round, fat globules, not only in the endoderm at the bases of the mesenterial filaments, but anywhere in the endoderm, indicates that there must be a true digestion—due to the secretion of the gland cells of the mesenterial filaments—and absorption over the whole endoderm, as well as ingestion at the bases of the filaments. No absorption would, however, seem to occur in the mesenterial filaments, the concentration of fat, etc., in the endoderm at their bases being correlated with this.*

It is unnecessary to repeat my views on the layers in the Actinozoon polyps.† There can be no doubt, if the descriptions and figures be carefully examined, that the external, tentacular, peristomial, stomodoeal and mesenterial filament epithelia of *F. rubrum* all belong to the same layer. The formation of the corallum, the apparent protandry of the generative organs, and the presence of a distinct canal leading through the endoderm to the ova have already been considered, and require no further reference here.

The post-larval stage in the development of the polyp, which I have described above, is remarkable in many ways. I have been over the anatomy many times, and I cannot see that there is or can be any error in the account of its gross anatomy. The main point of interest, a mouth almost as large as that of the calicle, I have found also in two younger stages, not however so well preserved. Such a stage is absolutely without parallel among the described developments of the Actinozoon polyps, which, from the first, have well-defined stomodoea. In the adult the stomodoeal wall is ridged over the attachments of the mesenteries, and in the stage described the mesenteries present are only such as in the adult depend from the stomodoeum. *The only logical method of conceiving the formation of the stomodoeum of the adult to take place is to suppose that the external body-wall grows inwards, catching up the edges of the mesenteries in its progress. It finally reaches the mesenterial filaments, which by fusion*

* *Vide* "La Digestion chez les Actinies," by Victor Willem, *Bull. S c. Médecine de Gand*, p. 295 (1892), and p. 375 of my paper "On the Anatomy of a Supposed New Species of Coenopsammia from Lifu," *Willey'e Zool. Results*, pp. 357-380 (1899).

† *Loc. cit*. p. 374-5.

*together, assisted by the downgrowth of the body-wall form the stomodoeum.* The latter increases in depth with the size of the polyp, and the process probably goes on to some extent throughout life.

It is necessary to lay strong emphasis on the fact that *this is a larval development.** The organs are functional, and the conditions of life are not quite the same as in the adult. All the organs are correlated with one another; the endoderm is digestive and everywhere ingests foreign particles.† In this stage there is a necessity for a rapid growth, for an abundant nutrition, which might he assisted by the widely open mouth. Perhaps there is no need of protection, so that the tentacles only appear later on to guard the polyp when it is producing generative organs. On the other hand the endodermal nematocysts are possibly now or were in the evolution of these forms at one time functional.

If a large number of the madreporaria be examined, I believe that in a not inconsiderable number a corresponding development will be found. The condition was probably brought about by an enormous enlargement of the gastropore in the first place, the stomodoeum then becoming of secondary formation. In the adult the stomodoeum is probably a definite morphological entity. Primitively it arises as an inpushing or ingrowth of the ectoderm at a very early stage of development. The adult stage is necessary to the organism. The variation has been produced and perpetuated in the young stage alone. This larva cannot be held to indicate in any way an ancestral stage of structure that has been hit upon by natural selection. It shows rather a variation on an entirely new line. The case is one which markedly emphasises the fact that the tendency in development is "to directness and abbreviation and to the omission of ancestral stages of structure," which here is as true for larval as for embryonic development.

* *Vide* "On the Law of Development commonly known as Von Baer's Law, and on the Significance of Ancestral Rudiments in Embryonic Development" by Adam Sedgwick, *Quart. Jour. Micro. Sci.*, vol. 36, and *Studies Morph. Lab. Camb.*, vol. vi., pp. 75-92 (1896).

† Perhaps the n matocysts in the endoderm at the edges of the tentacles were once functional at this stage in protecting the tissues of the polyp.

# EXPLANATION OF PLATES I-IV.

All the figures refer to *Flabellum rubrum* unless otherwise stated. *ect.* Ectoderm. *c. ect.* Calicoblast ectoderm. *end.* Endoderm. *s l.* Structureless lamella. *n. l.* Nervous layer of the ectoderm. *t. n.* Tentacular nematocysts. *end. n.* Reduced endodermal nematocysts. *m. g. c.* Mucous gland cells. *g. g. c.* Granular gland cells. *f. b.* Ingested foreign bodies. *f. g.* Fat globules. *m. f.* Muscular fibres.

Fig. 1. Section of the calicoblastic ectoderm on the side of a septum about 1 mm. inside the edge against the axial fossa.

Fig. 2. Section of the attachment of the body-wall to the corallum at the base of a mesentery.

Fig. 3. Section of the body-wall over a septum near its upper free edge.

Fig. 4. Section of the ectoderm of the external body-wall. (The section is that of a knob caused by the contraction of the polyp. It serves to show the constituents of the layer, but does not give in any way a real idea of its true appearance. It was chosen only after a prolonged search, no other section in this position showing more than 1 nerve cell and 2 or 3 granular gland cells. The vacuolated nature of the layer does not appear).

Fig. 5. Section through a battery of nematocysts on a partially retracted tentacle.

Fig. 6. Section through the ectoderm of the stomodoeal wall over the attachment of a mesentery.

Fig. 7. Section of the stomodoeal wall between the attachments of two mesenteries.

Fig. 8. Transverse section of the mesenterial filament and edge of a primary mesentery at about the middle of its course. (For the sake of clearness no tone has been placed over the structureless lamella).

Fig. 9. Reduced endodermal nematocyst, reconstructed from a series of sections.

Figs. 10-15. Various stages in the development of the corallite. The numerals where present refer to the cycles of the septa.

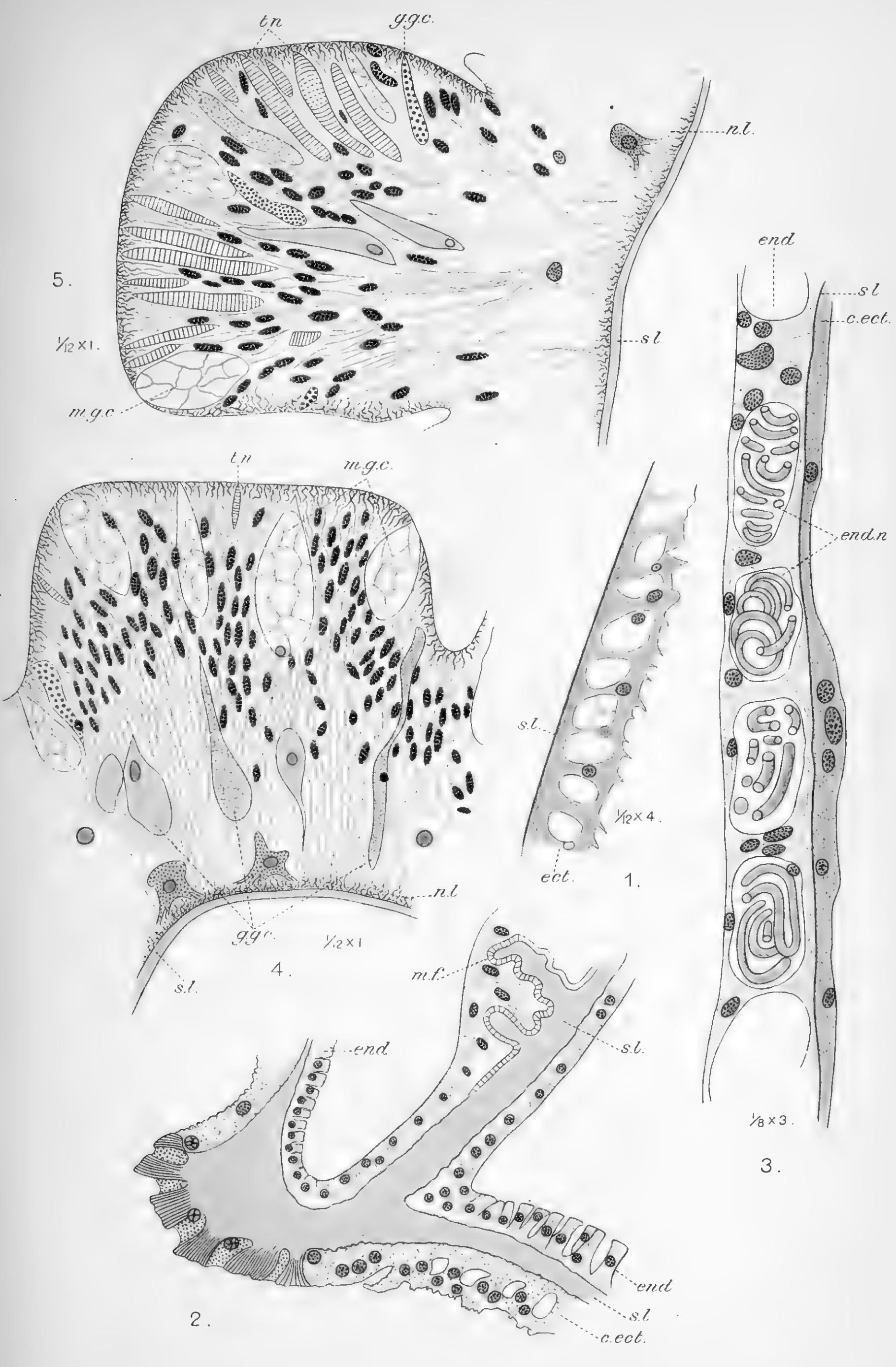
Fig. 16. Scar of a broken-off corallite. The dark lines in the septa are depressions, due to the eating away of the corallum along the central " dark lines " of the septa.

Fig. 17. Side view of a mesentery from a polyp of about 20 mm. in length, showing the coiled loop of the mesenterial filament, generative mass and arrangement of the muscular fibres. The filament is reversed so that the upper end is actually the more deeply situated in the corallum. The sperm acini contain ripe spermatozoa and on the inner side are seen three ova. To the right of the figure the clumped attachments of the muscular fibres to the corallum are seen.

Figs. 18-21. Views of four South African specimens of *F. pavoninum* from the side to show the general shape, accretion lines, wings, etc.

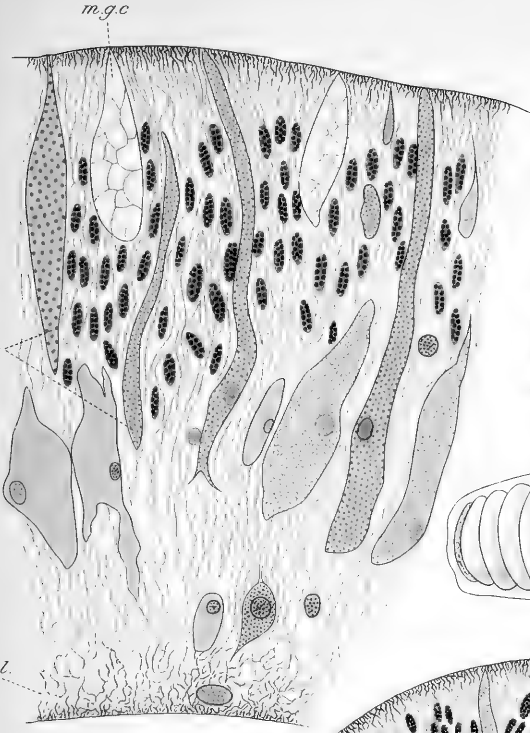
Figs. 22-34. Various corallites of *F. rubrum* from side view to show the variations in the shape of the corallum.

[PUBLISHED 21ST NOVEMBER, 1902.]

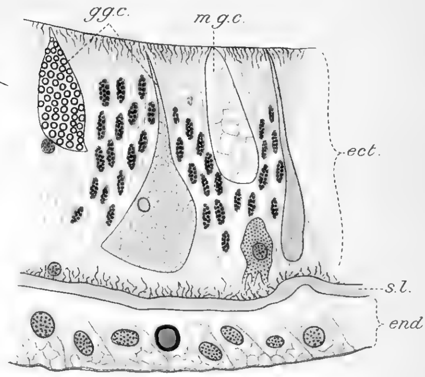



STANLEY GARDINER – FLABELLUM.

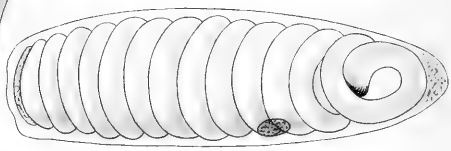
E. Wilson del. et lith. Cambridge.



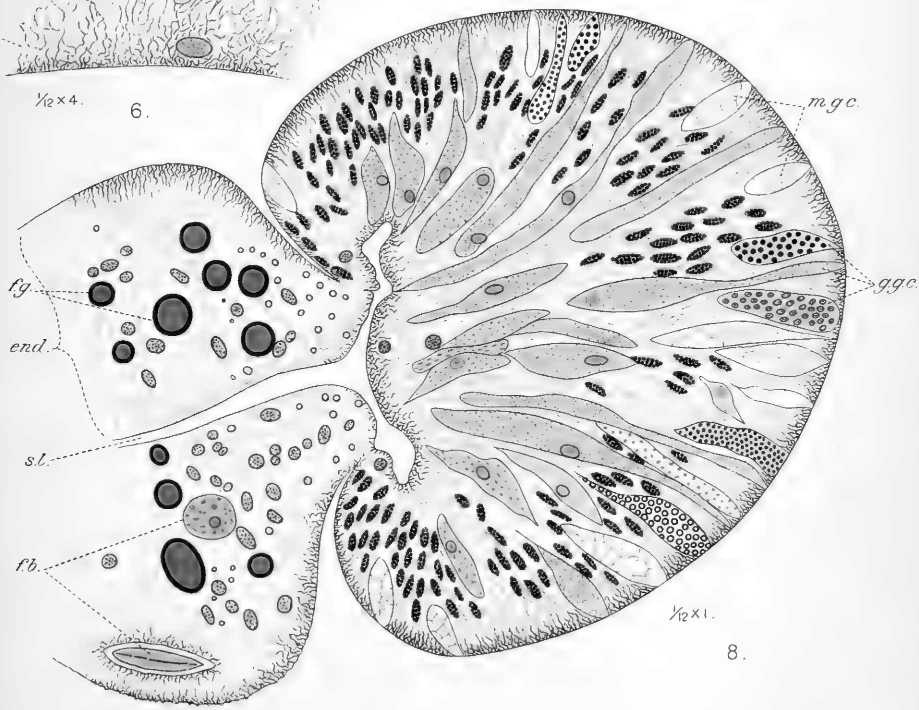

1/12×4. 6.




1/12×4. 7.



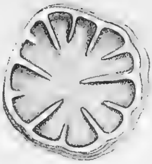
1/12×4. 9.



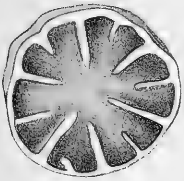

1/12×1. 8.

STANLEY GARDINER — FLABELLUM.

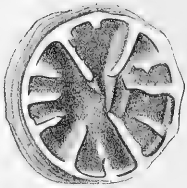
E. Wilson del. et lith. Cambridge.



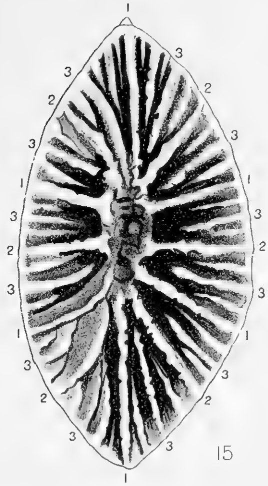
11.



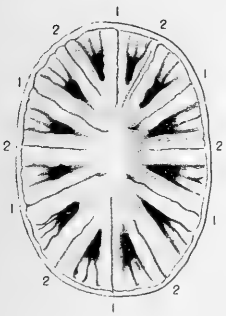
10.



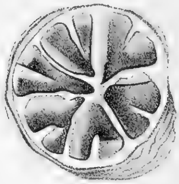
12



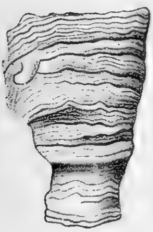
15



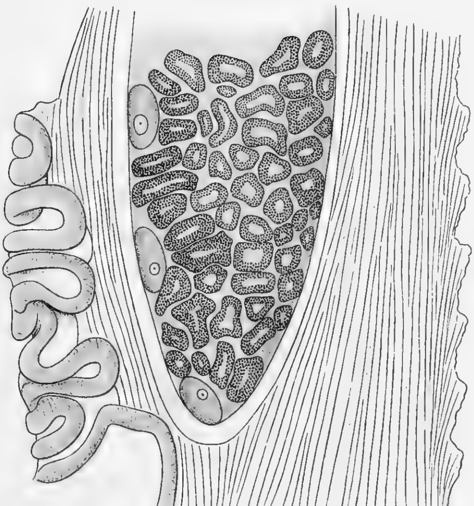
16.



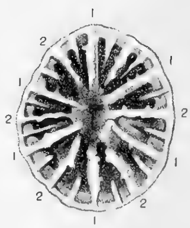
13.



14b.



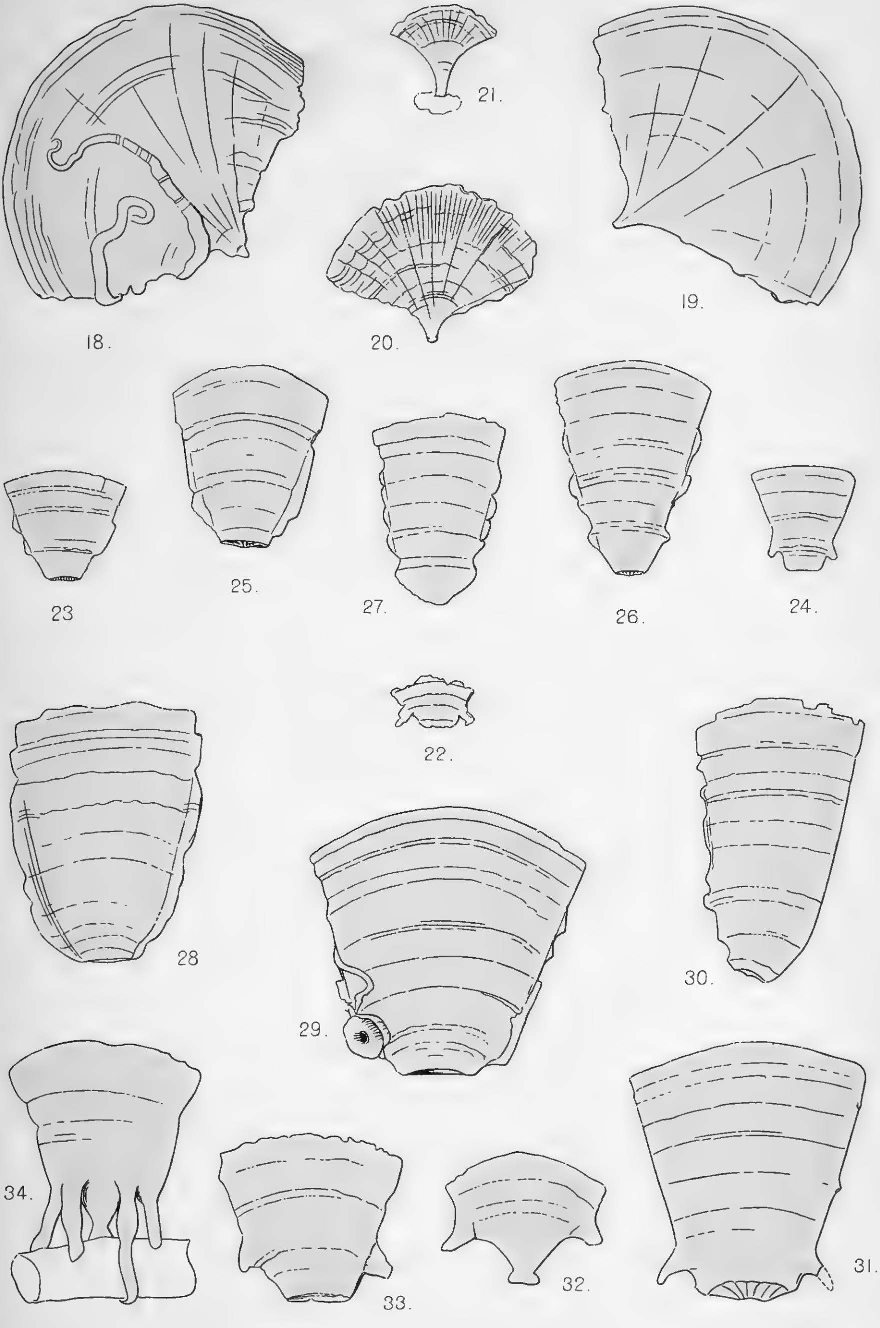
17.



14a.

STANLEY GARDINER - FLABELLUM.

E. Wilson del. et lith. Cambridge.




STANLEY GARDINER - FLABELLUM.

E. Wilson del. et lith. Cambridge.

# CURRENTS ON THE SOUTH AFRICAN COAST, AS INDICATED BY THE COURSE OF DRIFT BOTTLES.

By J. D. F. GILCHRIST, M.A., B.Sc., Ph.D.,

*Government Biologist to the Colony of the Cape of Good Hope.*

## Part I.

The following is a record of the course of a number of drift bottles sent off at various localities in the sea surrounding the South African coast.

The method adopted was simply to drop into the sea a small bottle (2 oz.) containing a card with a request to the finder to return it, after noting the locality and time at which the bottle was found. Such a method of testing currents, of course, raises the obvious objection that a record is got more of wind direction than of sea currents. This objection has already been discussed elsewhere, and it need only be repeated that while it is to a certain extent valid, yet, in view of the fact that the bottles when afloat are fairly well submerged, and that the winds themselves are the chief causes of all surface currents, we cannot but attach considerable importance to the results of such experiments. Moreover, we shall produce some direct evidence that the course taken at least in one case was to be attributed more to current than wind. Of particular interest in this respect is the directions taken by bottles Nos. 108, 296, 316, and 318, the last two being set off in practically the same place and at the same time, yet, apparently, taking quite opposite directions.

The bottles consist of two series, viz.:—First, those set off at fairly regular intervals, and at fourteen definite points along the coast between Cape Town and Natal, from the mail steamers. At the request of the Meteorological Commission of Cape Colony the Union-Castle Steamship Company most willingly undertook to assist in the investigations, and the results, of which only a part is here reported on, are of special value on account of their regularity. The bottles set off in this way were numbered consecutively, and are distinguished here by the addition of the letter "M." That no confusion might arise the card enclosed in the bottle was of a different colour from

others, and addressed to the Secretary to the Meteorological Commission. The second set of bottles were set adrift from the Government vessel at the various places at which it happened to be while engaged in marine investigations.

Many more bottles than those here recorded have now been returned, but for the sake of clearness the results of those set off between May, 1899, when the work began, and May, 1901, and received up to this date,* are here recorded in the form of a preliminary report.

It is not intended, therefore, even if this were at the present stage advisable, to do little more than record the results, and bring them together in a form which can readily be comprehended.

The accompanying tables and chart show details as to the time, localities, etc., in connection with the bottles which were recovered.

The interval between the casting adrift and landing of the bottle is, of course, not indicated by the difference between the dates, nor the number of miles drifted by the distance between the localities. The distance drifted, therefore, is taken to be approximately the shortest, and may be considered as the minimum; the time is necessarily the maximum (in one case where the bottle was found at sea, the actual time), and consequently the rate of speed given in the last column is the minimum.

The direction and force of wind when the bottles were cast adrift is also given.

A few of the most striking courses taken by the bottles may be noted. We find in the region west of the meridian of Cape Point evidence of a current going northwards, with an inset towards the coast in the neighbourhood of Saldanha Bay, the latter fact being of special significance in connection with the well-known dangerous character of this region for navigation. The existence of this current is well known to navigators, and is well marked, especially during south-east winds. Another fact, which does not seem to so well established, however, is perhaps indicated by the course of bottles Nos. 150, 149, 491, and 359. These point to the existence of a cross current towards Robben Island. The recent disaster to one of the mail boats, the "Tantallon Castle," while in a fog, and steering a course calculated to carry her past Robben Island on the west side, would apparently be explained by such an inset current towards the land. The courses of these bottles seem to indicate a fact well worthy of a fuller investigation from its purely practical aspect.

Bottle No. 296 is one of the most interesting. It was set off on the 11th June, 1900, $26\frac{1}{2}$ miles west of Cape Point during a

---

*16th December, 1901.

slight breeze from the west-south-west, and was found about a year afterwards (14th July, 1901) by Mr. M. J. Oliveira, a Customs House Officer, on the coast of Pernambuco, South America, having drifted a distance of more than 3,000 miles in this time, or at the rate of over eight miles a day. Its great distance from land had doubtless kept it clear of the South African coast until it got into the South Atlantic current, from whence it probably was carried with the North Equatorial current to the cost of South America.

That a drifting object, say, a log of wood or trunk of a tree, could be carried in such a comparatively short time from the coast of South Africa to that of South America is a fact which may throw some light on the geographical distribution of some animals. The distribution of such a form as *Peripatus*, for instance, could be accounted for on other grounds than those generally advanced, viz., the survival in widely separated regions of a form once universal. In the belief of my friend, Dr. Purcell, whom I have consulted, and who is well qualified to express an opinion on the subject, it is quite possible that this animal could survive such a journey, and from its habits is not unlikely to be occasionally carried out to sea with the drift wood from the rivers of South Africa. What is possible in a land form, such as this, is of course much more so in the case of floating marine forms which might be able to survive the various changes of temperature experienced in the different regions traversed. We have shown reasons for believing that the Agulhas Stream from the Indian Ocean reaches the region where the bottle in question was set adrift, and from which it was carried to a region within ten degrees of the Equator, where there are known to be currents passing into the northern hemisphere.

Nos. 161 and 164 are of interest, as they were cast adrift within a comparatively short distance (about two miles), and time (three hours) of each other, and were found at localities about one hundred miles apart. No. 161 was put overboard at 8.25 a.m., when there was no wind; No. 164 at 11.15 a.m., when a very slight north-west wind had sprung up. Apparently, the explanation is that by being about two miles further from the shore at the start No. 164 was able to clear the projecting part of the west coast. Any advantage to be gained by the north-west breeze in clearing the coast would, of course, be gained by No. 164. That this may not, however, be the explanation is demonstrated by the course of bottles Nos. 149 and 150, which were put over at the same time $1\frac{1}{2}$ miles off Lion's Head, and found on the shore near Table Bay, about three miles apart. (Compare also Nos. 374, 405, 453, 461, 465, and 573, and the numbers immediately following each of them.)

Passing to the region east of the meridian of Cape Point, we observe indications of a decided inset into False Bay, many of the recovered bottles put away off this region having been found in the Bay. No. 174 M is, apparently, an exception, but it is not impossible that this also circled round the Bay before being carried further eastwards.

Outside of these, however, one bottle, No. 108, was carried round Cape Point, and was found near Saldanha Bay. This is of special interest, as affording some evidence that the warm Agulhas current flows at least occasionally round Cape Point and up to the West Coast as a *surface* current. It was thrown off $14\frac{1}{2}$ miles south by west off Cape Hangklip on the 8th December, 1899, and was found about thirteen days later at Saldanha Bay. In this instance, the only such occurrence, it was picked up in the water, so that it probably went at the rate of about nine miles per day. When sent off there was a fairly strong westerly breeze. During the fourteen days which it took to complete the journey (118 miles) the wind, as ascertained at Cape Agulhas, Cape Point, and at the Royal Observatory by the Meteorological Commission, was as follows:—

| Date. | Cape Agulhas. | | Cape Point. | | Royal Observatory. | |
|---|---|---|---|---|---|---|
| Dec., 1899. | Direction. | Force. | Direction. | Force. | Direction. | Force. |
| 8th | Calm. | — | W. | 2 | S. | 0 |
| 9th | W. | 2 | S.W. | 2 | S.S.E. | 2 |
| 10th | S.W. | 2 | W. | 2 | Calm. | — |
| 11th | N.W. | 5 | N.W. | 6 | N.N.W. | 3 |
| 12th | W. | 7 | S.W. | 5 | W. | 1 |
| 13th | W. | 5 | N.W. | 5 | N.W. | 3 |
| 14th | S.E. | 2 | S.E. | 2 | S. | 3 |
| 15th | S.E. | 5 | S.E. | 6 | S. | 1 |
| 16th | N.W. | 1 | Calm. | — | S.S.E. | 0 |
| 17th | S.E. | 2 | S.E. | 5 | S. | 0 |
| 18th | S.W. | 6 | W. | 5 | W.N.W. | 2 |
| 19th | S.W. | 3 | S.W. | 2 | S. | 1 |
| 20th | S.E. | 2 | S.E. | 2 | S. | 3 |
| 21st | S.E. | 1 | S.E. | 6 | S.S.W. | 3 |

These observations, for a copy of which I am indebted to Mr. C. Stewart, B.Sc., Secretary to the Meteorological Commission, may be taken to fairly represent the prevailing direction and force of wind over the region through which the bottle passed between the 8th and 21st, the period of its drifting, and it will be seen at a glance that the direction, if wholly determined by the wind, would be an easterly, rather than a westerly one. When the bottle was dropped overboard there was a west by

north wind, force 3, and for six days afterwards the wind was westerly at Cape Point, so that we cannot but conclude that it is highly probably the course of the bottle round the Cape Peninsula is to be attributed to a current passing round that point from the east, against the wind.

The course of this bottle is of further interest in connection with a series of temperatures taken off the Cape Peninsula, where an unexpectedly high surface temperature (69°9) was found, being higher than any of the daily observations in False Bay or Table Bay during the three years 1898-1900. This was supposed to indicate the presence of the warm Agulhas current in the region as a *surface* current, and the course of this bottle gives additional evidence in favour of this interpretation.

At the region immediately off Cape Agulhas there seems to be a less definite set of the course of the drift bottles than anywhere else. As we proceed eastwards, however, there is a decided tendency towards the east off Cape Infanta and Cape Vacca, and this tendency is apparent along the whole of the remainder of the south coast up to Cape Recife, being specially marked in the case of bottles which travel long distances.

The course of Nos. 316 and 318 are peculiar. They were put into the sea at places only about eight miles apart, and at an interval of one hour and twenty minutes, and yet, apparently, took quite opposite directions, the one being found at Bredasdorp, west of Cape Agulhas, and the other at Plettenberg Bay.

The inset into Mossel Bay and Plettenberg Bay is to be noted here, and may be compared with the inset into False Bay and Table Bay. Nos. 374 and 375 were put over at the same time off Cape Infanta, and were found at Mossel Bay, one mile apart.

Any negative evidence afforded by drift bottles put away and not returned is perhaps of doubtful value, but the following short statement of the total numbers set adrift is appended as a record, which may prove of utility in further work:—

## SUMMARY OF BOTTLES SET ADRIFT.

### 1.—From the Union-Castle Mail Steamship Company's steamers on voyages between Cape Town and Natal, from 22nd December, 1900, to 25th May, 1901.

These bottles were supplied in sets of 28, two bottles being put over in the vicinity of each of the following localities: (1) Mouille Point; (2) Hout Bay; (3) Cape Point; (4) Cape Hangklip; (5) Danger Point; (6) Cape Agulhas; (7) Cape

Infanta; (8) Cape St. Blaize; (9) Knysna; (10) Cape St. Francis; (11) Cape Recife; (12) East London; (13) Port St. John's; and (14) Port Natal. The bottles containing cards with odd numbers were weighted, so as to become submerged. None of these have as yet been returned, and the method has since been discontinued.

Nos. 1 M.—28 M. December 22nd—28th, 1900. From R.M.S. "Scot," Captain T. J. Bremner. Nos. 14 M, 20 M, and 28 M returned.

Nos. 29 M—56 M. January 19th—February 3rd, 1901. From R.M.S. "Norham Castle," Captain R. E. H. Becher. Four returned Nos. 34 M, 36 M, 40 M, and 50 M

Nos. 57 M—84 M. March 14th—20th. From R.M.S. "Dunottar Castle," Captain H. Rigby. No. 68 M returned.

Nos. 85 M—112 M. March 30th—April 14th. From R.M.S. "Briton," Captain E. J. Griffin, Nos. 92 M and 98 M returned. The former, put away 12 miles south of Cape Hangklip, was found at Muizenberg about three days later, having travelled at the rate of over $10\frac{1}{2}$ miles a day.

Nos. 113 M—140 M. April 13th—19th. From R.M.S. "Kinfauns Castle," Captain R. Duncan. None returned.

Nos. 141 M—168 M. April 27th—May 12th. From R.M.S. "Norman," Captain R. Reynolds. No. 164 M returned.

Nos. 169 M—196 M. May 11th—19th. From R.M.S. "Braemar Castle," Captain J. W. Creaghe. No. 174 M, cast off 8 miles S.S.W. of Cape Point, was found on the beach at Hawston, having drifted eastwards a distance of 31 miles at a speed of more than 18 miles a day.

Nos. 197 M—224 M. Sent to Captain H. Rigby, R.M.S. "Dunottar Castle," on 25th May, 1901. No particulars received, and none of the bottles have been returned.

**2.—From the Government Trawler, "Pieter Faure," from 3rd May, 1899, to 31st May, 1901 :—**

Nos. 1—56. May 3rd—5th, 1899: On a voyage from Cape Town to Mossel Bay, at intervals of one hour. Of the 56 cast away, No. 2 was returned

Nos. 57—75. June 9th—10th: Ditto. Of the 19, No. 70, from Anchorage, Struis Bay, was returned.

Nos. 76—98. June 14th—July 27th: Twenty-three set off from about two to five miles off Cape St. Blaize. None returned.

Nos. 99 and 100. There were no cards for these numbers.

Nos. 101—119. December 5th—9th: Nineteen, on a voyage from Cape Town to Mossel Bay. No. 108 found off Saldanha Bay. Nos. 116 and 119 in Mossel Bay.

Nos. 120—132. December 13th, 1899—February 1st, 1900: Thirteen, off Cape St. Blaize, two to six miles. Nos. 121, 125, 128, 131, and 132 found on beach, from Mossel Bay east to Zwart River.

Nos. 133—150. February 2nd and 3rd: On a voyage between Mossel Bay and Cape Town. Of the eighteen put away, four were returned, No. 138 from Fish Hoek, No. 145 from Saldanha Bay, Nos. 149 and 150 from Blueberg Beach.

Nos. 151—275. March 5th—May 4th: One hundred and twenty-five, west and south of Cape Peninsula, 2 to 75 miles off shore. Of these, 3 out of 14, put off on March 6th, within, 12 miles of Lion's Head, were returned, two from near Saldanha Bay and one from further north. Of the 51 put off west of the Meridian of Cape Point, at a greater distance from shore, none were returned. There were southerly and northerly winds at this time. Of the few (6), however which were put off about the same time east of the meridian of Cape Point, one was carried into False Bay (No. 263), the most easterly one. Taken by itself this fact might be of little weight, but along with other observations it would seem it gives at any rate a provisional locality where the Agulhas current branches off to the right into False Bay, and to the left round the Peninsula to proceed up the west coast. The course of bottles Nos. 263 and 108 may be glanced at on the accompanying chart to illustrate what is meant, and perhaps as additional evidence.

Nos. 276—283. May 25th—26th: Eight set off on west coast. One, No. 276, sent off near Vondeling Island, was found four days later further south, nearly opposite Dassen Island. A north wind (force 3) was blowing at the time it was cast away, though on the following day the wind was southerly. This is the only one in this region which has taken a southerly direction.

Nos. 284—301. June 2nd—12th: Eighteen put away off Cape Point. One (No. 289), driven on shore by south-west wind from off Buffels Bay to Smitswinkel Bay. Eight were put off from 22 to 35 miles in a westerly direction from Cape Point. Of these, one (No. 296), was returned from Pernambuco.

Nos. 302—353. June 23rd—July 21st: 52 put off in region between Cape Agulhas and Izervark Point. Of the 6 returned, 5 went in an easterly direction to some considerable distance, but one went to the west in an opposite direction.

Nos. 354—361. July 21st—24th: Eight, between Cape Agulhas and Cape Town. One (No. 359) sent off with strong south wind, was carried from off Cape Point to Table Bay.

Nos. 362—372. August 9th—10th: Eleven, between Cape Town and Cape Agulhas. One (No. 364) drifted a short dis-

tance southerly on west of Cape Peninsula, and one (No. 371) eastwards, an exceptional direction here, past Danger Point.

Nos. 373—392. August 10th—17th: Twenty, between Cape Agulhas and Cape St. Blaize. Two (Nos. 374 and 375) recovered.

Nos. 393—406. August 17th—September 7th: Fourteen put off near Cape St. Blaize. Five got back, viz.: Three put off 8 to 10 miles off Cape St. Blaize carried far to eastwards, two to near Knysna, and one to Cape Recife; two, only 4 miles off, carried into Mossel Bay. From this and other evidence there seems to be an inset round Cape St. Blaize eastwards into Mossel Bay, but further from this point a current eastwards.

Nos. 407—474. September 12th—October 18th: Sixty-eight, between Cape St. Blaize and Plettenberg Bay. Fifteen returned, carried no great distance along the coast, about equally in a westerly and easterly direction.

Nos. 475—490. October 22nd—November 8th: Cape St. Blaize to Cape Town. Of the sixteen cast away, Nos. 475 and 481 got back, the former indicating an inset into Mossel Bay, a short distance off Cape St. Blaize, and the latter a general easterly trend off Cape Infanta.

Nos. 491—521. December 6th—10th: Cape Town to Natal. Of the 31 put away, 5 got back, No. 491 showing inset into Table Bay, No. 498 showing westerly current into Struis Bay (c.f. Admiralty chart), No. 507 showing westerly current from Cape Recife, No. 511 showing westerly current from East London, No. 521 showing current in opposite direction, northwards, from Cape Natal.

Nos. 522—581 December 13th, 1900—May 31st, 1901: Off the Natal coast. Of 60 put away 5 were returned. No. 522 was put off three days after No. 521, but was carried in the same northerly direction, though not so far. No. 539 was put off at Noon, 3 miles off the shore, and was found at 5 o'clock of the same day about four miles further up the coast, and must have travelled at a speed of more than 19 miles a day. Nos. 573 and 574, put off together, two miles off the Umzimbaza River, were found five and a half hours afterwards, about five miles southwards of that point, and within a few yards of each other, having drifted at the rate of over $21\frac{1}{2}$ miles per day, a record speed, so far as these investigations are concerned. No. 570 is of quite a different nature, having travelled southwards the great distance of 386 miles.

[PUBLISHED, 27TH FEBRUARY, 1903.]

Drift Bottles Sent Off from the Mail Steamers of the Union-Castle Coy. and Returned.

| Ref. No. | PUT INTO THE SEA. Date | Time | Name of Vessel | Captain | Locality | Wind Direction | Wind Force | RECOVERED. Date | Time | Locality | Interval D.H.M. | Estimated Distance in Miles | Rate per Day in Miles |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 M | 23.12.00 | 6.45 a.m. | R.M.S. Scot.. .. | T. J. Bremner.. | Cape Infanta, N., 12 miles | W.S.W. | 6 | 5.1.01 | .. | Izervarkfontein, Riversdale | 13 0 0 | 43 | 3·3 |
| 20 M | 23.12.00 | 11.15 p.m. | „ .. .. | „ .. | Cape St. Francis, N. 10 miles | S.W. | 2—3 | 8.1.01 | .. | Near Fish Point Light House | 16 0 0 | 127 | 7·9 |
| 28 M | 28.12.00 | 11,30 a.m. | „ .. .. | „ .. | Port Natal, W. 1 mile | E.N.E. | 4—5 | 1.1.01 | .. | About 4 miles from the Port | 4 0 0 | 4 | 1· |
| 34 M | 19.1.01 | 9.55 „ | R.M.S. Norham Castle | R. E. H. Becher | Cape Point, N.E. x E. ½ E., 4 miles | W.N.W. | 7 | 20.2.01 | 12.30 p.m. | Between Cape of Good Hope and Cape Point | 1 2 35 | 6 | 5·4 |
| 36 M | 19.1.01 | 11.7 „ | „ .. .. | „ .. | Cape Hangklip, N.E. x E. ½ E., 10 miles | W.N.W. | 7 | 28.1.01 | 10.30 a.m. | Between Somerset Strand and Gordon's Bay | 8 23 23 | 23 | 2·5 |
| 40 M | 19.1.01 | 3.52 p.m. | „ .. .. | „ .. | Cape Agulhas, N E. ½ N., 5 miles | N.W. | 6 | 22.1.01 | 2 p.m. | Arniston Downs, Bredasdorp | 2 22 8 | 22 | 7·5 |
| 50 M | 20.1.01 | 12.45 „ | „ .. .. | „ .. | Cape Recife, N. 3 miles | W. | 8 | 26.1.01 | 10 a.m. | On shore between St Croix and Bird Islands | 5 21 15 | 24 | 4· |
| 68 M | 15.3.01 | ? | R.M.S. Dunottar Castle | H. Rigby .. | Cape Agulhas, N. 5 miles | ? | .. | 22.3.01 | .. | Brakfontein, near L'Agulhas | 7 0 0 | 9 | 1·2 |
| 92 M | 30.3.01 | 1.45 p.m. | R.M.S. Briton .. | E. J. Griffin .. | Cape Hangklip, N. 12 miles | W.N.W. | 2 | 2.4.01 | 6 p.m. | Muizenberg .. | 3 4 15 | 34 | 10·7 |
| 98 M | 30.3.01 | 8.47 „ | „ .. .. | „ .. .. | Cape Infanta, N. 20 miles | Variable | 0—2 | 4.4.01 | 11.45 a.m. | Port Beaufort .. | 4 14 58 | 24 | 5·1 |
| 164 M | 1.5.01 | 8.45 a.m. | R.M.S. Norman .. | R. Reynolds .. | East London, W. 1·7 miles | W.N.W. | 5 | 2.5.01 | .. | Between Nahoon and Gouwlie Rivs. | 1 0 0 | 8 | 8· |
| 174 M | 11.5.01 | 8.26 p.m. | R.M.S. Braemar Castle | J. W. Greaghe.. | Cape Point, N.N.E. 8 miles | N.N.W. | 6 | 13.5.01 | 1 p.m. | Hawston Beach, Caledon | 1 16 34 | 31 | 18·3 |

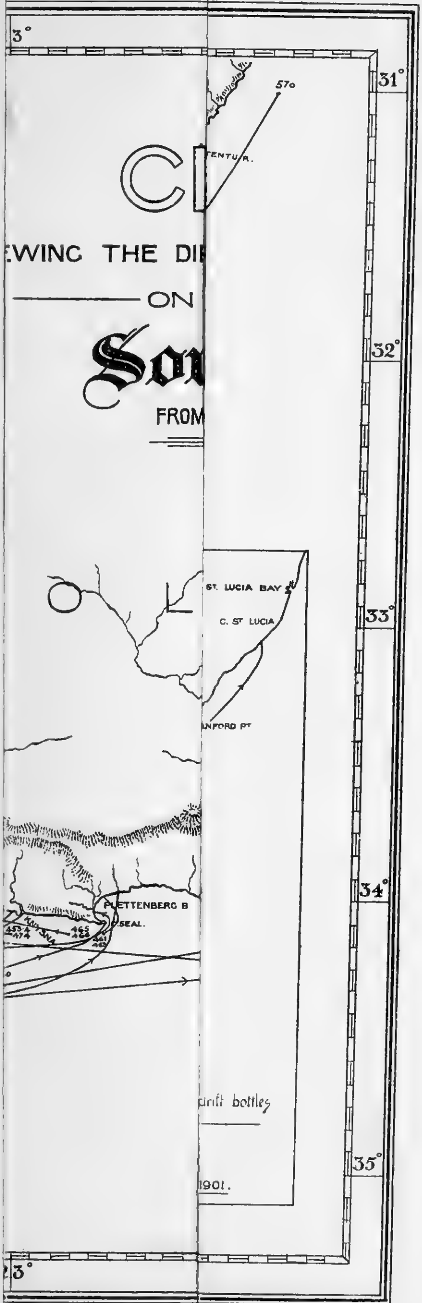
## Drift Bottles Sent Off from Government Steam Trawler *Pieter Faure* and Returned.

| Ref. No. | PUT INTO THE SEA. Date | Time | Locality | Wind Direction | Wind Force | RECOVERED. Date | Time | Locality | Interval D. H. M. | Estimated Distance in Miles | Rate per Day in Miles |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 3.5.99 | 11.30 a.m. | Lat. 34° 0′ 30″. Long. 18° 18′ 30″ E. .. | Calm | .. | 5.5.99 | 6 a.m. | Nord Hoek Strand .. .. | 1 18 30 | 7 | 3·9 |
| 70 | 10.6.99 | 7.35 ,, | Anchorage, Struis Bay,.. .. .. | ,, | .. | 11.6.99 | 2.45 p.m. | Struis Bay .. .. .. | 1 7 10 | 1 | ·7 |
| 108 | 8.12.99 | 5.30 p.m. | Cape Hangklip, N. x E., $14\frac{1}{2}$ miles .. | W. x N. | 3 | 21.12.99 | 3 ,, | Off Saldanha Bay .. .. | 12 21 30 | 118 | 9·1 |
| 116 | 9.12.99 | 11 a.m. | Izervark Point, N.E. $\frac{3}{4}$ E., 12 ,, .. | Calm | .. | 22.12.99 | 3 ,, | 3 Miles east of Brak River .. | 13 4 0 | 50 | 3·7 |
| 119 | 9.12.99 | 4.5 p.m. | Anchorage, Mossel Bay.. .. .. | S.E. | 1 | 10.12.99 | 7 a.m. | Mossel Bay .. .. .. | 14 55 | $\frac{1}{2}$ | ·8 |
| *121 | 13.12.99 | 2.15 ,, | Cape St. Blaize, W. x N., 2 miles .. .. | W. | 5 | 16.12.99 | .. | Near Mossel Bay .. .. | 3 0 0 | 6 | 2· |
| *125 | 7.1.00 | 8.30 a.m. | Anchorage, Mossel Bay.. .. .. | S.E. | 2 | 7.1.00 | 3.15 p.m. | Voor Baai (Mossel Bay) .. | 6 45 | $\frac{1}{2}$ | 1·7 |
| 128 | 16.1.00 | 2 p.m. | Cape St. Blaize, W. x S., 5 miles.. .. | W.S.W. | 1 | 18.1.00 | 7.30 a.m. | Mouth of Hartenbosch River Mossel Bay | 1 17 30 | 8 | 4·6 |
| *131 | 29.1.00 | 1.30 ,, | ,, ,, W. $\frac{1}{2}$ N., $5\frac{1}{4}$ ,, .. .. | W. | 3 | 25.8.00 | .. | Near mouth of Zwart River .. | 208 0 0 | 27 | ·1 |
| 132 | 1.2.00 | 1.15 ,, | ,, ,, W. $\frac{3}{4}$ N., $6\frac{1}{4}$ ,, .. .. | S.E. | 2 | 17.2.00 | 12.30 p.m. | Mossel Bay.. .. .. | 15 23 15 | 7 | ·4 |
| 138 | 2.2.00 | 6 ,, | Cape Agulhas, N.W. $\frac{1}{2}$ N., $11\frac{1}{2}$ ,, .. .. | S.W. | 2 | 23.12.00 | 1 ,, | Fish Hoek, near Simon's Bay .. | 323 19 0 | 103 | ·3 |
| 145 | 3.2.00 | 8 a.m. | Off Slangkop Point, $5\frac{1}{4}$ miles .. .. | S. x W. | 2 | 13.2.00 | .. | Schryvers Hoek, Saldanha Bay .. | 10 0 0 | 58 | 5·8 |
| 149 | 3.2.00 | 10.20 ,, | Off Lion's Head, $1\frac{1}{3}$ miles .. .. | Calm | .. | 4.2.00 | 10.30 a.m. | Riet Vlei Mouth .. .. | 1 0 10 | 8 | 7·9 |
| 150 | 3.2.00 | 10.20 ,, | .. ,, ,, .. .. | ,, | .. | 4.2.00 | 1.15 p.m. | Near entrance to Blaauwberg Village | 1 2 55 | 9 | 8· |
| 154 | 6.3.00 | 7.15 ,, | ,, $4\frac{3}{4}$ ,, .. .. | ,, | .. | 27.3.00 | .. | North Bay (Saldanha Bay) .. | 21 0 0 | 58 | 2·7 |
| 161 | 6.3.00 | 8.25 ,, | Lion's Head, S.E. $\frac{1}{4}$ S., 11 miles .. .. | ,, | .. | 10.3.00 | .. | Schryvers Hoek, Saldanha Bay .. | 4 0 0 | 40 | 10· |
| 164 | 6.3.00 | 11.15 ,, | ,, S.E. $\frac{1}{4}$ E., $12\frac{1}{2}$ ,, .. .. | N.W. | 0·5 | 30.4.00 | 8 a.m. | Waterbak, Van Rynsdorp .. | 54 20 45 | 143 | 2·6 |
| 263 | 26.4.00 | 11.30 ,, | Nasco de Gama Pk., N. 37° W., 8 miles .. | N. | 5 | 29.4.00 | noon | Kalk Bay Beach .. .. | 3 0 30 | 19 | 6·2 |
| 276 | 25.5.00 | 10.30 ,, | Vondeling Island (Saldanha Bay), N. $\frac{1}{4}$ W. $3\frac{1}{2}$ | N. | 3 | 29.5.00 | .. | Rondeberg, near Darling .. | 4 0 0 | 15 | 3·7 |
| 289 | 2.6.00 | 2.45 p.m. | Off Buffels Bay, 2 miles .. .. | S.W. | 1 | 10.6.00 | .. | Smitswinkel Bay, near Simon's Bay | 8 0 0 | 4 | ·5 |
| 296 | 11.6.00 | 2.45 .. | Cape Pt. Light House, East, $26\frac{1}{2}$ miles .. | W.S.W. | 2 | 14.7.01 | .. | Pernambuco, South America .. | 398 0 0 | 3,400 | 8·5 |
| 307 | 23.6.00 | 10.30 a.m. | Izervark Point, N. x E. $\frac{3}{4}$ E., 6 miles .. | Calm | .. | 19.8.00 | .. | Geelhoutboom, Humansdorp .. | 57 0 0 | 150 | 2·6 |
| 308 | 23.6.00 | 11.30 ,, | Bull Point, N.W. x N. $\frac{1}{2}$ N., $6\frac{1}{2}$ miles .. | ,, | .. | 8.8.00 | .. | Zitsikamma River Mouth .. | 46 0 0 | 130 | 2·8 |
| 316 | 29.6.00 | 3.45 p.m. | Cape Barracouta, N.E., $6\frac{1}{2}$ miles .. .. | E.S.E. | 2 | 6.1.01 | .. | Buffelsjagd, Elim, Bredasdorp .. | 191 0 0 | 92 | ·4 |
| 318 | 29.6.00 | 5.5 ,, | Morris Point, N. x E., 9 miles .. .. | ,, | 2 | 4.11.00 | noon | Matjesfontein, Plettenberg Bay .. | 127 18 5 | 115 | ·9 |
| 324 | 2.7.00 | 10.20 a.m. | Cape St. Blaze, N.N.E., $2\frac{1}{2}$ miles .. .. | W. | 1 | 16.10.00 | .. | Plettenberg Bay .. .. | 106 1 40 | 66 | ·6 |
| 351 | 21.7.00 | 1 p.m. | Cape Infanta, E. $\frac{1}{2}$ N., $15\frac{1}{2}$ miles .. .. | S.W. | 1 | 12.8.00 | ., | Kaffir Kuils River Mouth, Still Bay | 21 23 0 | 47 | 2·1 |
| 359 | 24.7.00 | 10.55 a.m. | Cape Point, S.E. x E., 9 miles .. .. | S. | 6 | 7.9.00 | .. | Between Melkbosch and Blaauwberg | 45 0 0 | 38 | ·8 |
| 364 | 9.8.00 | 12.50 p.m. | Off Slangkop Point, 2 miles .. .. | W.N.W. | 1 | 16.12.01 | noon | Oliphants Bosch .. .. | 493 23 10 | 7 | ·01 |
| 371 | 9.8.00 | 7.45 ,, | Cape Hangklip, North, 15 miles .. .. | S.S.E. | 1 | 11.8.00 | .. | Hazel Kraal, Breadsdorp .. | 2 0 0 | 26 | 13· |
| 374 | 13.8.00 | 8.10 a.m. | Cape Infanta, N.E. $\frac{1}{4}$ N., 3 miles .. .. | W.N.W. | 2 | 8.9.00 | 5 p.m. | Voor Baai (Mossel Bay) .. | 26 8 50 | 83 | 3·1 |
| 375 | ,, | ,, ,, | .. .. | ,, | 2 | 8.9.00 | 3.30 ,, | ,, ,, .. | 26 7 20 | 83 | 3·1 |
| 395 | 27.8.00 | 5.30 p.m. | Cape St. Blaize, N.N.E., 8 miles.. .. | S.W. | 1 | 22.9.00 | .. | Between Gouwkamma and Zwart River Mouth, Knysna | 26 0 0 | 35 | 1·3 |
| 398 | 28.8.00 | 2.10 ,, | ,, N.W. x W. $\frac{3}{4}$ W., 9 miles .. | S. | 1 | 17.9.00 | 6 a.m. | Buffalo Bay .. .. .. | 19 15 50 | 33 | 1·6 |
| 399 | 30.8.00 | ,, ,, | ,, W. x N. $\frac{1}{4}$ N., $10\frac{1}{2}$ ,, .. | W.S.W. | 2 | 29.9.00 | 3 p.m. | Cape Recife .. .. .. | 30 0 50 | 174 | 5·7 |
| 405 | 7.9.00 | 12.50 ,, | ,, N.W. x W. $\frac{1}{2}$ W., 4 ,, .. | ,, | 2 | 14.9.00 | .. | Great Break River Mouth .. | 7 0 0 | 9 | 1·2 |

## Drift Bottles Sent Off from Government Steam Trawler *Pieter Faure* and Returned.—*Continued.*

| Ref. No. | PUT INTO THE SEA. Date | Time | Locality | Wind Direction | Wind Force | RECOVERED. Date | Time | Locality | Interval | Estimated Distance in Miles | Rate per Day in Miles |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 406 | 7.9.00 | 12.50 p.m. | Cape St. Blaize, N.W. x W. ½ W., 4 miles .. | W.S.W. | 2 | 8.9.00 | .. | Two miles from Mossel Bay .. | 1 0 0 | 8 | 8· |
| 419 | 17.9.00 | 3 .. | " N. ½ E., 5½ " .. | S. | 1 | 30.9.00 | 10 a.m. | Great Brak River Mouth .. | 12 19 0 | 13 | 1· |
| 422 | 18.9.00 | 2.50 .. | " N. 15° W., 7 " .. | S.S.E. | 1 | 2.11.00 | 3 p.m. | Zwart Vlei, George .. | 45 0 10 | 29 | ·6 |
| 425 | 20.9.00 | 3 .. | " N.N.W., 5 " .. | W.S.W. | 3 | 28.9.00 | noon | " .. | 7 21 0 | 23 | 2·9 |
| 431 | 3.10.00 | 9.15 a.m. | Gayang River Mouth, N.W. ½ N., 9 " .. | N. | 1 | 27.10.00 | .. | Falcomb, Knysna .. | 24 0 0 | 25 | 1· |
| 433 | " | 11.35 .. | " " N. ¾ W., 18 " .. | W.S.W. | 2 | 7.11.00 | 10 a.m. | Between Keiskamma River and Zwart Vlei | 34 22 25 | 18 | ·5 |
| 445 | 10.10.00 | 7.30 .. | Walker Point, E. x S., 5 miles .. | W. x N. | 2 | 22.10.00 | 9 .. | Between Touws River and Zwart Vlei | 12 1 30 | 14 | 1·1 |
| 450 | 11.10.00 | 11.50 .. | Knysna Heads, N.E. ¾ E., 12½ miles .. | W.S.W. | 1 | 19.10.00 | .. | Cape Seal, Plettenberg Bay .. | 8 0 0 | 25 | 3·1 |
| 453 | 15.10.00 | 11.25 .. | Malgat River, N. x W. ¼ W., 6½ " .. | S.W. | 1 | 18.10.00 | 7 p.m. | Voor Baai (Mossel Bay) } | 3 7 35 | 45 | 13·5 |
| 454 | " | " " | " " " 6½ " .. | " | 1 | 18.10.00 | 7 .. | " } | | | |
| 460 | " | 3.10 p.m. | Walker Point, E. x S., 5 miles .. | Calm | .. | 23.10.00 | .. | Near Flesh Bay .. | 8 0 0 | 50 | 6·2 |
| 461 | 17.10.00 | 6.45 a.m. | Plettenberg Bay, Cape Seal, S.W. x W., 2¼ miles | N. | 0·5 | 26.10.00 | .. | Between Keurbooms and Matjes River } | 9 0 0 | 10 | 1·1 |
| 462 | " | " | " " 2¼ " | " | 0·5 | 26.10.00 | .. | Within 300 yards of No. 461 } | | | |
| 465 | " | 9.40 .. | Cape Seal, E. x S. ½ S., 8 miles .. | N.W. | 0·5 | 22.10.00 | .. | Mossel Bay .. } | 5 0 0 | 58 | 11·6 |
| 466 | " | " " | " " " 8 " .. | " | 0·5 | 22.10.00 | .. | " .. } | | | |
| 474 | 18.10.00 | 4.20 p.m. | Malgat River Mouth, N. x W. ¼ W., 6½ miles | S.W. | 0·5 | 27.10.00 | 3 p.m. | Harold's Bay, George .. | 8 22 40 | 34 | 3·8 |
| *475 | 22.10.00 | 10 a.m. | Cape St. Blaize, North, 5 miles .. | S.S.W. | 1 | 27.10.00 | 8 a.m. | Between Little Brak and Hartenbosch Rivers | 4 22 0 | 11 | 2·2 |
| 481 | 8.11.00 | 6.5 .. | Cape Infanta, N.E. ¾ N., 17¾ miles .. | S.W. | 1 | 17.1.01 | .. | Buffels Hoek, Riversdale .. | 70 0 0 | 57 | ·8 |
| 491 | 6.12.00 | 6.30 .. | Green Point Light House, South, 1 mile .. | W.N.W. | 1 | 20.1.01 | 5 p.m. | Melkbosch, Blaauwberg .. | 45 10 30 | 7 | ·1 |
| 493 | 7.12.00 | 4 .. | Cape Infanta, N. x E., 15 miles .. | N.W. | 2 | 15.12.00 | noon | Wagenhuis Krantz, Bredasdorp .. | 8 8 0 | 36 | 4·3 |
| 507 | 8.12.00 | noon | Cape Recife, N.W. ¾ W., 5¼ miles .. | W. x N. | 1 | 1.5.01 | .. | Zeekoe River Mouth, Humansdorp | 144 0 0 | 47 | ·3 |
| 511 | 9.12.00 | 4.15 a.m. | East London, E.N.E. (D.R.), 8 miles .. | N.N.W. | 1 | 14.12.00 | .. | Kasouga, Bathurst .. | 5 0 0 | 70 | 14· |
| 521 | 10.12.00 | 8 p.m. | Cape Natal Light House, N.E. ¼ N., 10 miles | N.E. | 4 | 9.1.01 | .. | 15 miles south of St. Lucia Bay, Zululand | 30 0 0 | 115 | 3·8 |
| 522 | 13.12.00 | 8 a.m. | " " N.W., 4 " | E.N.E. | 1 | 16.12.00 | 10 a.m. | Tongaat River Mouth, Natal .. | 3 2 0 | 19 | 6·1 |
| 539 | 14.1.01 | noon | Morewood Cove, N. x W., 3 miles .. | E.S.E. | 1 | 14.1.01 | 5 p.m. | Umhlali, Natal, about 1½ miles N. of Morewood Cove | 5 0 | 4 | 19·2 |
| | 14.3.01 | .. | Port Shepstone, N.E. x N. ¼ N., 16 miles .. | E.N.E. | 1 | 3.8.01 | noon | Zitzikamma Point, Humansdorp .. | 142 0 0 | 386 | 2·7 |
| | 15.3.01 | " | Off Umzimbaza River Mouth, 2 " .. | E. | 2 | 15.3.01 | 5.30 p.m. | One mile south of Umkomaas River } | 5 30 | 5 | 21·8 |
| | " | " | " " 2 " .. | " | 2 | 15.3.01 | " | " " " } | | | |

* Course marked on Chart but numbers not inserted.


3°
31°
32°
33°
34°
35°
23°
570
TENTU R.
C
EWING THE DI
ON
So
FROM
ST. LUCIA BAY
C. ST LUCIA
ANFORD PT
PLETTENBERG B
SEAL.
drift bottles
1901.

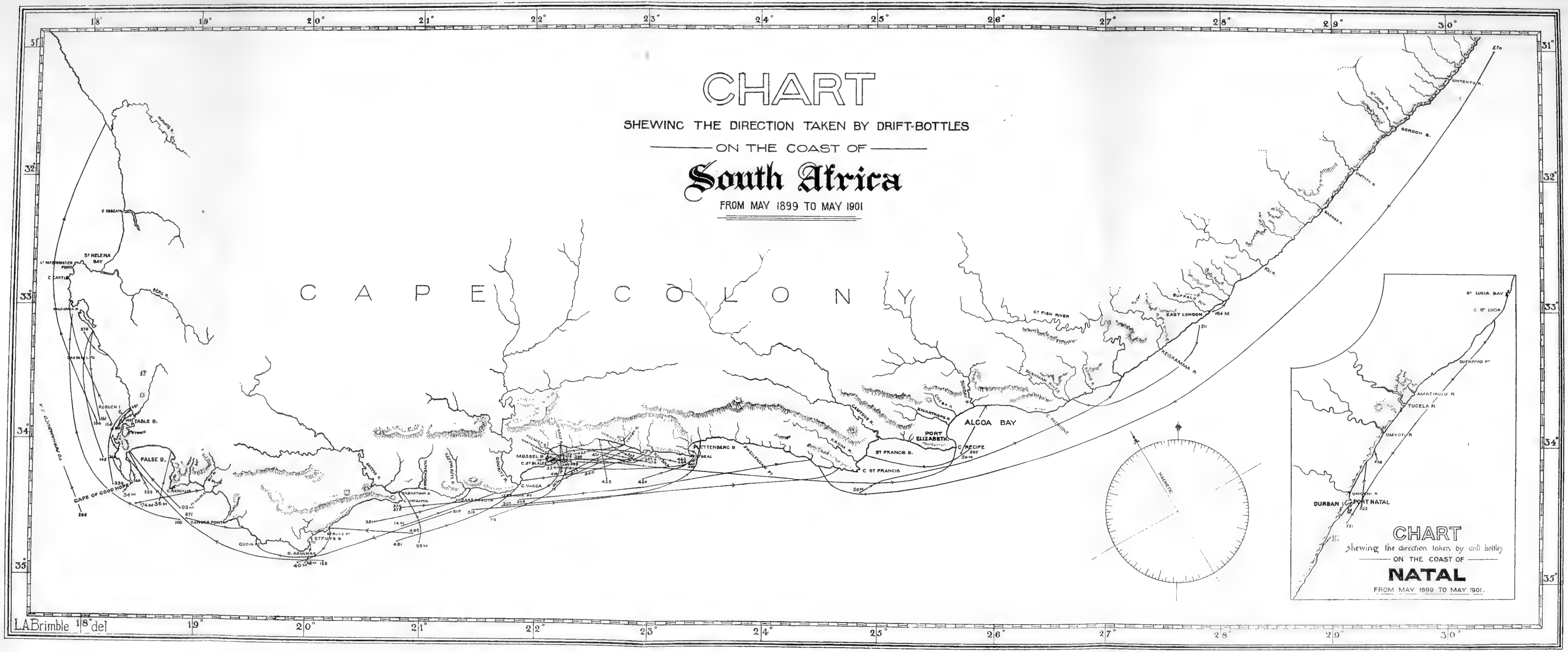


CHART
SHEWING THE DIRECTION TAKEN BY DRIFT-BOTTLES
ON THE COAST OF
South Africa
FROM MAY 1899 TO MAY 1901
CAPE COLONY
St HELENA BAY
ROBBEN I.
TABLE B.
FALSE B.
CAPE OF GOOD HOPE
C. AGULHAS
MOSSEL B.
C. ST BLAIZE
C. VACCA
PLETTENBERG B.
SEAL
C. ST FRANCIS
ST FRANCIS B.
PORT ELIZABETH
C. RECIFE
ALGOA BAY
C. PADRONE
EAST LONDON
BUFFALO RIV.
KEI R.
MAGNETIC
DURBAN
PORT NATAL
UMVOTI R.
TUCELA R.
AMATIKULU R.
St LUCIA BAY
C. St LUCIA
CHART
shewing the direction taken by drift bottles
ON THE COAST OF
NATAL
FROM MAY 1899 TO MAY 1901.
L.A.Brimble 18 del

DESCRIPTIONS OF TWO

# NEW DEEP-SEA FISHES

FROM

# SOUTH AFRICA.

By G. A. BOULENGER, F.R.S.

---

### *Notacanthus annectens.*

(Plate XI.)

Body strongly compressed, its depth double its width and contained $3\frac{3}{4}$ times in the distance from end of snout to vent, the length of the head being contained $2\frac{2}{3}$ times; tail $1\frac{1}{2}$ length of head and body. Snout acutely pointed, scarcely compressed, strongly projecting, $1\frac{1}{2}$ the diameter of the eye, which is 5 times in length of head and $1\frac{1}{2}$ in interocular width; mouth crescentic, its width equal to the length of the snout; end of maxillary below centre of eye, armed with a strong spine; lip papillose, thick, not forming a fold round the upper jaw, as it does at the sides of the mandible; 24 premaxillary and 28 mandibular teeth on each side. Gill-membrane angularly notched in the middle, as far as the vertical from the upper end of the gill-opening; gill-rakers rather large, 7 on lower part of anterior arch. Dorsal spines 7, the first opposite to the vent, the last or longest only half the diameter of the eye. Anal with 13 spines and 160 soft rays; spines increasing in length to the last, which measures $1\frac{1}{2}$ the diameter of the eye. Pectoral $\frac{3}{5}$ the length of the head. Ventral shorter, extending to the vent, joined to its fellow, with 2 spines and 6 branched rays; first spine very short, second nearly as long as the eye. Scales very minute, in 25 longitudinal series between the first dorsal spine and the lateral line, in 45 series between the latter and the vent, of nearly equal size all over the head and body; lateral line well marked, straight, nearer to the dorsal than to the ventral outline throughout. Pale brownish, blackish about the mouth and gill-cleft and towards the end of the anal fin.

Total length 355 millimetres.

This new species is interesting as occupying an intermediate position between *N. sexspinis*, Richardson, and *N. (Gigliolia) moseleyi*, Goode and Bean (*N. bonapartii*, Gthr.), of both of

which the types are preserved in the British Museum. The number of teeth is about the same in all three, but *N. annectens* differs from *N. sexspinis* in the series of dorsal spines beginning just above the vent, in this respect agreeing with the definition of the genus *Gigliolia* of Goode and Bean. But I can find no justification for this genus, since the second character on which it was founded, viz., the absence of an upper labial fold, is shared by *N. sexspinis*, which is besides more nearly related to *N. annectens* than the latter is to *N. moseleyi*, a species with a less pointed snout, a much shorter body, more numerous anal spines and larger scales (16 between the first dorsal spine and the lateral line and 32 between the latter and the vent). The discovery of *N. annectens* thus disposes of the generic distinction proposed by the American authors. I may add that the shape of the snout of the new species is intermediate between that of *N. sexspinis* and that of *N. moseleyi*.

Procured 40 miles off the Cape Peninsula (Table Mountain bearing N. 79° E.); depth, 250 fathoms; bottom, green sand.

## **Tripterophycis**, gen. nov.*

Body elongate, compressed, much attenuate posteriorly, with very short præanal region, covered with small smooth scales. Head short; eye large; nostrils close together, close to the eye; mouth moderate, jaws with a single series of small, closely set, truncate, compressed teeth; palate toothless; a mental barbel. Seven branchiostegal rays. Three dorsal fins, the first very small and on the nape, the second short and deep, behind the vertical of the vent, the third elongate and low, widely separated from the second and nearly reaching the caudal. A single anal fin, measuring more than three fourths the total length. Caudal fin small, but distinct from dorsal and anal. Ventrals reduced, with narraw base, composed of five rays, the two outer of which are prolonged and filamentous.

This new genus occupies an isolated position in the Phycine group of the Gadidæ, being the only one to combine a tripartite dorsal fin with a single anal.

### *Tripterophycis Gilchristi.*

(Plate XII.)

Depth of body slightly greater than length of head, six times in total length. Head once and a half as long as broad, covered with scales above and on the sides, the scales largest on the interocular region and occiput; snout rounded, scarcely projecting beyond the mouth, shorter than the eye, the diameter of which

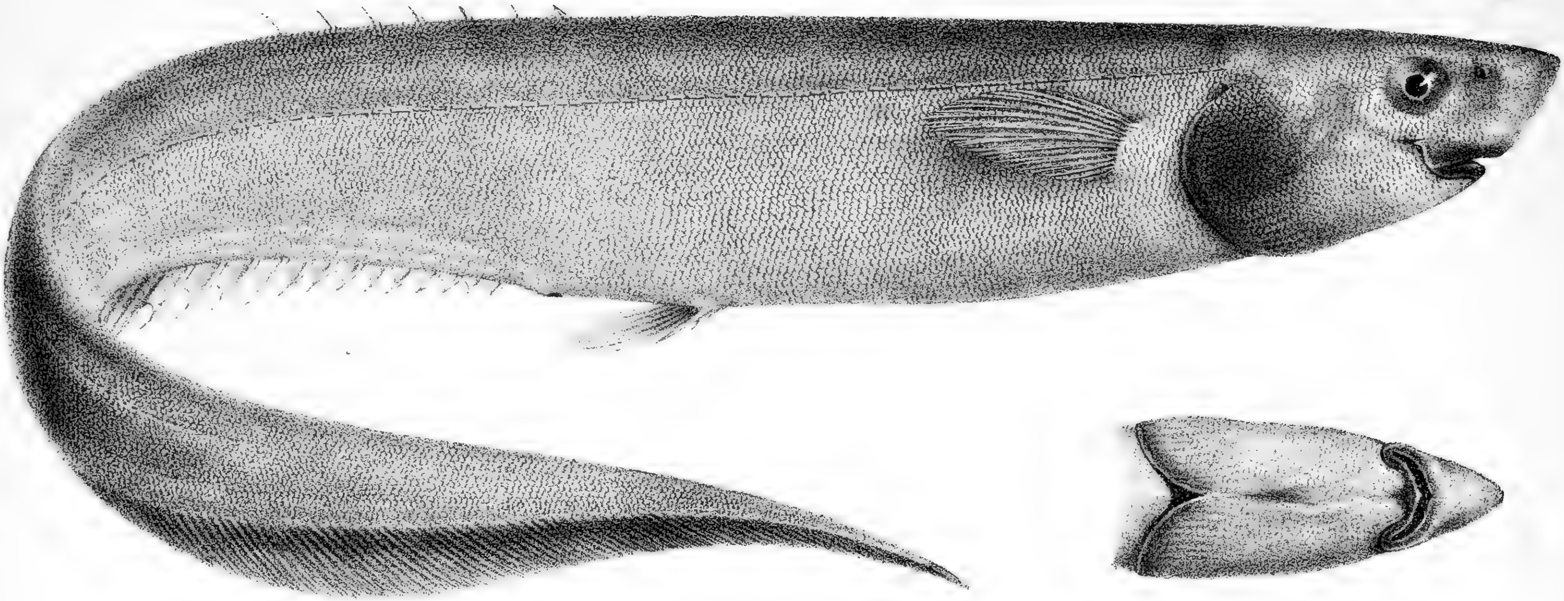
*See also "*Annals and Magazine of Natural History*," *Sec. 7, Vol. IX., May* 1902.

is $\frac{1}{3}$ the length of the head and $1\frac{1}{4}$ the interocular width; maxillary extending to below centre of eye; mental barbel $\frac{1}{4}$ the diameter of the eye. Gill-rakers long and slender, 11 on lower part of anterior arch. First dorsal with five feeble simple rays, the first the longest and measuring $\frac{1}{3}$ the length of the head. Second dorsal much more developed than and narrowly separated from the first, with 12 rays, all branched except the first; second and third longest, as long as the head. Third dorsal with 38 short feeble rays, its base shorter than its distance from the second dorsal. Anal originating a little in advance of the second dorsal, composed of 103 subequal rays, which measure about $\frac{1}{3}$ the length of the head. Pectoral rather high up the side, with 15 rays, about $\frac{2}{3}$ the length of the head. Longest ventral ray $1\frac{1}{4}$ the length of the head. Caudal fin obtusely pointed, half the length of the head. 140 scales in a longitudinal series, 17 between the origin of the second dorsal fin and the lateral line, which is perfectly distinct. Yellowish brown, finely speckled with dark brown; abdominal region bluish black.

Total length 210 millim.

I am indebted to Dr. J. D. F. Gilchrist for the favour of describing this most interesting fish, with which it gives me great pleasure to connect the name of its discoverer. The single specimen sent to me was obtained some 40 miles off Table Mountain, at a depth of 250 fathoms.

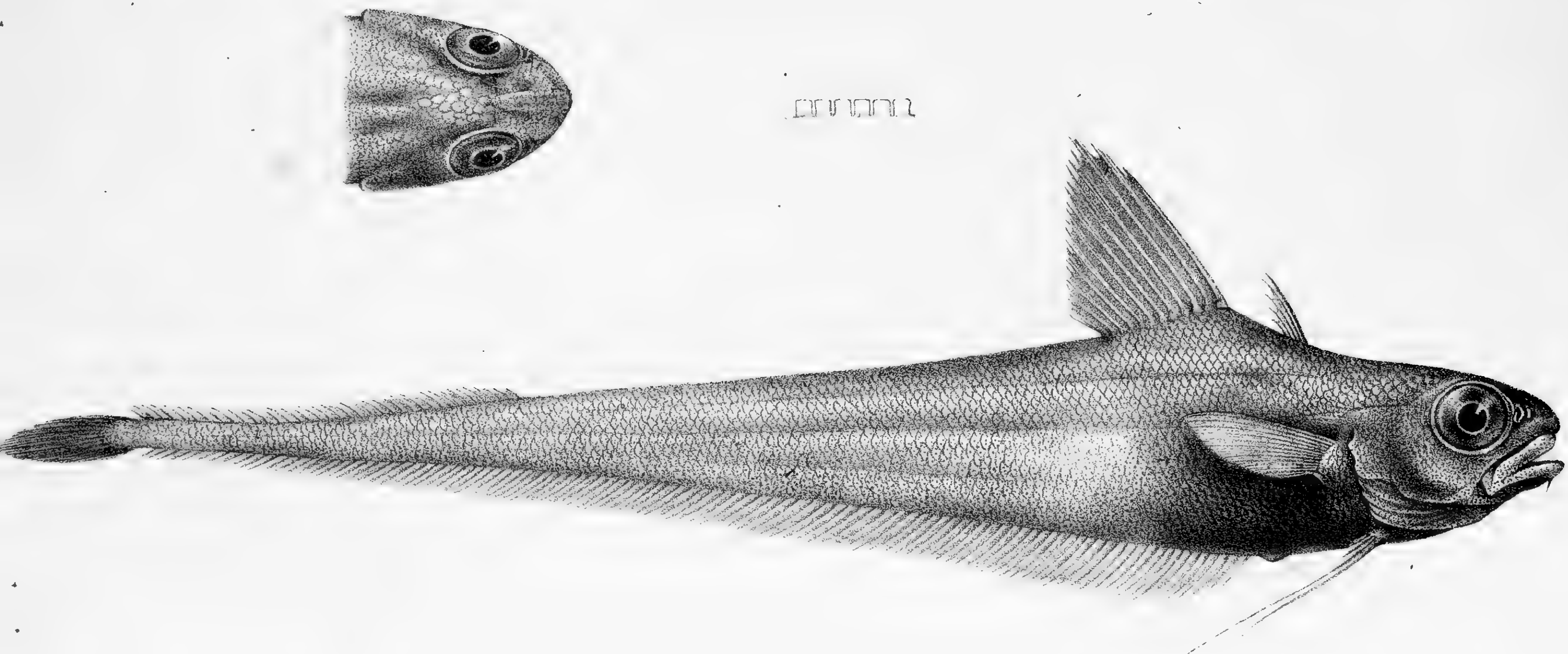
[Published, 28th February, 1903.]



J. Green del. et lith.

Mintern Bros. imp.

NOTACANTHUS ANNECTENS.



J. Green, del. et lith.

Mintern Bros. imp.

TRIPTEROPHYCIS GILCHRISTI.

*With upper view of head and enlarged view of mandibular teeth.*

# DESCRIPTIONS

OF

# SOUTH AFRICAN SPONGES

## PART II.

BY

R. KIRKPATRICK, F.Z.S.
BRITISH MUSEUM (NATURAL HISTORY)

The present paper includes a description of the Lithistid Sponges obtained by Dr. J. D. F. Gilchrist off the Cape and Natal coasts, and sent by him to the British Museum (Natural History). The collection comprises eight specimens representing four species, all of which are new, and four genera, of which three are new. A description is given also of a new species of *Triptolemus* found in the canals of a dead Lithistid skeleton. The following is a list of the genera and species :—

Order **LITHISTIDA.**

Sub-Order HOPLOPHORA.

Family **Tetracladidæ.**

**Discodermia natalensis**, sp. n.

Family **Scleritodermidæ.**

**Microscleroderma hirsutum**, gen. et sp. nov.

Sub-Order ANOPLIA.

Family **Azoricidæ.**

**Lithobactrum forte**, gen. et sp. nov.

## Family **Desmanthidæ**.

**Monanthus plumosus**, gen. et sp. nov.

# Order **CHORISTIDA**.

## Family **Theneidæ**.

**Triptolemus incertus**, sp. n.

**Discodermia natalensis**, sp. n.

Plate iv., figs. 2, 2a-k, and 3, 3a-d.

Sponge cup-shaped, sub-pedicellate. Outer or poral surface smooth, showing a fine branching venation ; inner or oscular surface showing broad bands of minute circular oscules, and beneath the surface, lines of orifices of excurrent canals radiating from the base to the edge of the cup. Pores in groups of two, three, or four, in sub-circular pore areas 150 $\mu$ in diameter ; oscules in oscular areas about 250 $\mu$ in diameter, usually one, but occasionally two oscules in each area.

Spicules. Megascleres.—Desma with cylindrical smooth or slightly tuberculated epactines ($100 \times 3\ \mu$) dividing into much tuberculated branches, the tubercles cylindrical with flattened summits or forming sharp ridges ; crepidial axes, each 55 $\mu$.

Phyllotriæne of poral surface : rhabdome 90 $\mu$, conical, pointed ; cladome tetracladose, the branches enclosing almost circular pore areas ; protocladi 90 $\mu$, deuterocladi 60 $\mu$, tritocladi from 60—100 $\mu$ ; crepidial axes about 40 $\mu$.

Discotriæne (or modified phyllotriæne) of oscular surface with irregularly lobed disk, sometimes giving off three unequal cladi ; crepidial axes about 30 $\mu$.

Style $360 \times 7.5\ \mu$, in sparsely scattered bundles near and at right angles to the surface.

Oxea $750 \times 6\ \mu$, slender, straight or irregularly curved.

Tyle $140 \times 5\ \mu$, head 6 $\mu$ in length and width, neck 4·5 $\mu$, scattered about in the tissues.

(These small tyles might be included among the microscleres).

Microscleres.—Microxea $80 \times 1\ \mu$, slender, straight, smooth.

Microstrongyle $20 \times 3\ \mu$, straight, fusiform, with granular surface.

Colour dull white, texture hard.

Localities : The type specimen from Natal coast (O'Neil Peak bearing N.N.W. $\frac{1}{4}$ W., distant 8 miles), depth, 55 fathoms ; bottom, broken shells.

A second specimen (much worn) also from Natal (Cape

Vidal bearing N.N.E. $\frac{1}{4}$ N., distant $9\frac{1}{2}$ miles), depth, 80–100 fathoms; bottom, rock.

The type specimen has evidently been cut in half, one piece only having been sent to the British Museum.

The cup, which is shallow and expanded, is about 7 cm. in diameter, at the mouth, with an inside depth of 3 cm., and a height of 6 cm., the wall being 1 cm. thick.

The second specimen, which I at first thought to belong to a different species, is also only a half specimen; the shape is rather that of a vase or funnel than a cup, the height being 5 cm., diameter of mouth 7 cm., depth of cavity 4·25 cm., and thickness of wall 6 cm. The walls of the second specimen are flexible, and resemble dark sandstone in appearance; the whole ectosomal surface has been worn away, leaving only the framework of desmas; the spicules (desmas, styles, microxea) resemble those of the type specimen, but the microstrongyles (Fig. 3d) vary slightly, being for the most part cylindrical rather than fusiform. Interspersed through the skeletal framework is a new species of *Triptolemus*, which is described at the end of this paper.

The new species is most nearly related to *Discodermia discifurca* Sollas from Port Jackson; the slender, straight, smooth microxeas of the former differ markedly from the thicker, curved granular microxeas of the latter species. Further, the small tyles scattered in some abundance in the tissues of *D. natalensis* form a distinctive feature.

## Family **Scleritodermidæ.**

### **Microscleroderma**, gen. nov.

**Scleritodermidæ** in which the ectosomal spicules are minute sigmaspires.

### **Microsleroderma hirsutum**, sp. n.

Sponge cup-shaped, expanding from a short massive pedicel. Inner surface uniformly covered with slightly raised oscules 1·2 mm. in diameter, and smooth between the oscules. Outer surface pilose and corrugated, the thick rounded rugæ running from base to edge and branching more or less dichotomously; pores, about ·25 mm. in diameter, distributed over extensive cribriform areas in the fossæ and valleys between the rugæ. Edge of cup thick and rounded. Colour of dried specimens pale brown; white in section.

*Skeleton* formed of monocrepid desmas united into a regular honeycomb-like framework, with oval smooth-edged fenestræ

$320 \times 220\ \mu$ in diameter; with bundles of oxeas between the longitudinal rows of fenestræ, and passing 2 to 4 mm. beyond the outer surface, thus giving rise to a finely hirsute appearance especially in the fossæ and valleys.

Ectosomal spicules minute sigmaspires.

*Spicules.*—Oxeas 2000 to $5000 \times 12$ to $30\ \mu$, slender, often undulating in outline, tapering to sharp points.

Desma, generally with curved or semilunar epirhabd averaging $400 \times 30\ \mu$ and often bifurcate at the ends, smooth on the concave edge, tuberculated and cladose on the convex surface, one cladus in the middle of the convexity, often being of large size and uniformly tuberculated; again, the epirhabd may be almost straight and uniformly tuberculated and cladose.

Sigmaspire, $16.5 \times 1.2\ \mu$, usually C-shaped, occasionally with an extra coil, with rounded ends and with granular surface. (The thickenings at the ends, shown in Fig. 1e, disappear on focussing carefully.)

Locality: Durnford Point, Natal, bearing N.W. ¾ W., distant 12 miles; depth, 90 fathoms; bottom, broken shells.

There are two specimens of this species, the dimensions in centimetres being as follows:–

| | Large Specimen. | Small Specimen. |
|---|---|---|
| Height ... ... | 17 | 5·5 |
| Diameter of orifice ... | $22 \times 18$ | 6 |
| Length of pedicel ... | 3 | 1.3 |
| Diameter ,, ... | $7 \times 5$ | $3 \times 2$ |
| Thickness of wall ... | 1.5 | ·57 |
| Depth of cavity ... | 11 | 2.5 |

On the outer surface of the larger specimen is an ashen gray patch of dead sponge 3 cm. in diameter and 3 mm. in thickness. Several small holes on the surface lead to sand-lined tubes, probably of some worm. The desmas are thicker and more tuberculated in the patch than elsewhere.

The absence of ectosomal microstrongyles from this species led me to suspect that the spicules of this kind occurring in *Scleritoderma flabelliforme* Sollas and *S. packardi* Schmidt were large sigmaspires, and a careful examination tended to confirm this view. The microstrongyles of *S. flabelliforme* are identical with the sigmaspires in all respects except size, since they are C shaped, occasionally with an extra coil, with rounded ends and granular surface; the resemblance in the case of *S. packardi* is less obvious. The ectosomal rhabdi of *Aciculites,* which are curved and usually with granular ends, are also possibly developed from minute sigmaspires.

Briefly, the three genera of *Scleritodermidæ* are thus characterised :—

*Microsclerodermа*, ectosomal spicules minute sigmaspires.
*Scleritoderma*, ectosomal spicules minute sigmaspires, and microstrongyles (? large sigmaspires).
*Aciculites*, ectosomal spicules rhabdi only (? modified sigmaspires).

## Family **Azoricidæ**.

### **Lithobactrum**,* gen. nov.

*Azoricidæ* massive club-shaped, with uniformly distributed pores at the sides, and with numerous small oscules on the rounded summit; with fine parallel incurrent canals radiating horizontally inwards from the pores, and excurrent canals passing vertically upwards to the oscules.

### **Lithobactrum** forte sp. n.

Plate iv., figs. 5, 5a-g.

Sponge with characters of the genus.

Pores nearly circular, .25 mm. in diameter; oscules, .75 to 1 mm. in diameter, flush with the surface, sharp edged, oval or circular, in groups with an obscurely radiating arrangement.

Skeleton composed of monocrepid desmas, forming a compact lining to the canals, but looser between the canals.

Spicules.—Desmas of the usual monocrepid type (Fig. 5c-f), $450 \times 50$ $\mu$; crepis 70 $\mu$.

Amphityle $992 \times 8$ $\mu$, with long oval heads, one larger than the other, the larger being $14 \times 8$ $\mu$, and the smaller $10 \times 5$ $\mu$.

Other kinds of monaxon spicules (oxeas, styles, tyles) occur, but are very probably adventitious. The amphityles occur deep in the sponge, and intimately associated with the desmas.

Colour, glistening white.

Locality: O'Neil Peak, Natal Coast, bearing N.N.W. ¼ W., distant 8 miles; depth, 55 fathoms; bottom, broken shells.

Following the example of Schmidt and Sollas, the characters of the genus have been based on the external form and the arrangement of the pores, oscules and canal-system; and as Azoricid sponges are devoid of an ectosomal skeleton and of microscleres, there is not much else to fall back upon.

There are two specimens of this fine sponge. The larger grows from an expanded base ($7 \times 5$ cm.), immediately above

* λίθος stone, βάκτρον club.

which it contracts, and then expands gradually to the summit. The height is 18 cm., breadth 8.5 cm., and thickness 4.5 cm., so that the club is slightly flabelliform; the area of the rounded summit is $5 \times 4$ cm.

The smaller specimen has been broken off sharp from its attachment, exposing excurrent canals 1 mm. in diameter; its shape is more cylindrical than the first, and resembles a milestone; its height is 7 cm., and its diameter 4 cm., the diameter at the base being 2.4 cm., and at the summit $3 \times 2$ cm.

Locality: O'Neil Peak, Natal Coast, bearing N.N.W. $\frac{1}{4}$ W., distant 8 miles; depth, 55 fathoms; bottom, broken shells.

## Family **Desmanthidæ.**

### **Monanthus**, gen. nov.

*Desmanthidæ* in which the skeleton is formed of monocrepid desmas *of the common type*, separate or joined together, and of monaxon megascleres.

### **Monanthus plumosus**, sp. n.

Plate iv., figs. 6, 6a-e. Figs. 7, 7a, b.

Description of the type specimen (Fig. 7, 7a, b). Sponge forming a thick white crust, firm but compressible, with several round oscules flush with the surface.

Skeleton composed of plumose columns extending from base to surface, and formed of bundles of oxeas (mostly) and styles; between the columns monocrepid desmas isolated and separate or here and there loosely articulated with each other.

Spicules.—Desma, with smooth epirhabd $140 \times 40$ $\mu$, often bifurcating at each end with flattened branches, sharp-edged or expanded into flattened articular surfaces; crepidial axis 80 $\mu$.

Oxea, $480 \times 25$ $\mu$, smooth, curved, sharp-pointed.

Style, $600 \times 28$ $\mu$, slightly curved.

Thiele (Ueber *Crambe crambe* (O.S.) Archiv. f. Naturgesch, 1899, p. 89) expresses doubt whether Topsent's genus *Desmanthus* is Lithistid or Monaxonid; and possibly the position of *Monanthus* would be subject to the same doubt. The desmas of *Desmanthus* are tetracrepid, and those of *Monanthus* monocrepid; in both instances the desmas seem to be of the ordinary Lithistid type, though in the case of *Monanthus* they often appear to be undergoing degeneration; even in isolated spicules, however, well formed articular surfaces often persist, clearly showing that these spicules are derived from forms which were part of an articulated Lithistid skeleton. In the deeper parts of the type specimen, and in the second specimen of *M. plumosus*, where

portions of articulated skeleton persist, the monaxon spicules are only few in number, but the latter become abundant where the desmas are few in number or absent.

The specimen (Fig. 7) encrusts *Pachastrella isorrhopa* Kpk, and in its complete state (for part of it has been cut off and retained by Dr. Gilchrist) it probably formed a circular patch about 5 cm. in diameter, ·6 cm. thick in the centre, and sloping down to a thin rounded margin.

A second specimen (Fig. 6) of what appears to me to belong to the same species, and which I name var. *tubulatus*, presents in its mode of growth certain remarkable features which seem to be due to adaptation.

In a deep fissure in a specimen of *Pachastrella isorrhopa* there were two white tubes, 2.3 cm. in length and 2 mm. in diameter. On cutting into the *Pachastrella* the tubes were seen to emerge from an irregularly shaped nodule about 25 mm. in diameter embedded in the sponge, and only distinguished from the rest of the *Pachastrella* by a slight difference in shade.

The oscular tubes are composed of two layers, an inner formed of fan-shaped bundles of oxeas, arranged spirally and obliquely upwards, and an outer layer formed of a felt work of oxeas.

The nodule is formed of bundles of oxeas and styles and of patches of monocrepid desmas of nearly the same character of those of the above described type specimen; the oxeas and styles were usually slightly larger, viz., about 900 $\mu$, and the desmas thicker and with larger articular surfaces.

Although the body of the Lithistid is completely surrounded and, to all appearances, incorporated, yet under the microscope the thin line of the dermal membrane of the *Pachastrella* can be made out.

Carter points out (Ann. Mag. N. H. 1876 (4), xviii., p. 410) that it is a characteristic of *Pachastrella* to incorporate any objects with which it comes in contact. In the case of the second specimen of *M. plumosus*, the oscular tubes appear to have arisen in response to the needs of the sponge, so nearly engulfed by the *Pachastrella* on which it grew.

The inclusion of *Monanthus* in the family *Desmanthidæ* (*see* Mém. Soc. Zool France, 1898, xi., p. 231) renders necessary a slight enlargement of Topsent's definition, viz.: to "mégasclères monactinaux," to add "ou diactinaux."

Localities: Both the typical form and var. *tubulatus*, encrusting or invested by *Pachastrella isorrhopa*, from the Natal Coast (Cone Point bearing N.W. ½ W., distant 4 miles) depth, 34 fathoms; bottom, broken shells. The typical form also from E. London Coast (lat. 33° 6′ 30″ S., long. 28° 11′ E.) depth, 85 fathoms, encrusting *Placospongia labyrinthica*.

**Triptolemus incertus**, sp. n.

Plate iv., figs. 4 and 4a-f.

Description.—The sponge burrows in the canals of the dead skeleton of a specimen of *Discodermia natalensis* mihi. A section of the *Discodermia* (Fig. 4, between the crosses) shows the larger incurrent and excurrent canals more or less filled up with centrotriænes of all sizes. The only other spicules proper to this species of *Triptolemus* are small curved, smooth microxea and very minute metasters, the latter being rare.

Spicules. Megascleres.—Centrotriænes of various sizes, the cladi being simple or branched one, two, or three times, usually dichotomously, but sometimes into three branches not in the same plane; frequently the final branches are curved.

Dimensions of a large spicule: rhabdome 310 μ, straight, pointed; protocladi 180, deuterocladi 90.

Microscleres.—Microxea, 100 × 3 μ to 180 × 4 μ, fusiform, smooth, curved, sharp-pointed.

Metaster, total length including spines, 10 μ.

There are four known species of *Triptolemus*, viz.: *T. intextus* Cr., *T. parasiticus* Cr., *T. cladosus* Sollas, and the present form. *T. intextus* has microxeas bearing blunt spines; the centrotriænes are only 180 μ, those of *T. incertus* being 500 μ; on the other hand, the amphiasters of Carter's species are 100 μ in length.

Sollas's species contains both smooth and trichose microxeas; and the centrotriænes do not attain to such a size as those of *T. incertus*.

The total diameter of a large centrotriæne of *T. cladosus* is only 142 μ.

The habitats of the four species are as follows:—

*Triptolemus intextus* Cr. on a Lithistid (*Corallistes bowerbankii*) from St. Vincent, 374 fathoms.

*T. parasiticus*, on a specimen of Carpenteria; habitat unknown.

*T. cladosus* Sollas, found with a Lithistid, *Corallistes thomasi*, from near the Ki Islands, 140 fathoms.

*T. incertus* mihi, Cape Vidal, Natal coast, bearing N.N.E. ¼ N., distant 9½ miles; depth, 80-100 fathoms; bottom, rock; burrowing in a Lithistid (*Discodermia natalensis* mihi).

---

Note on *Tetilla casula* (Carter).

Dr. Gilchrist writes to me:—"We now have in the tanks of our Marine Station living specimens of the peculiar hemispherical sponge with flat under surface (*Tetilla casula*, Carter). This form seems to be an adaptation to prevent sinking into the sand, as the animal in the tank remained steadily on the surface of the sand on which it was placed."

A brief description with figures of a specimen of this species sent to the Museum by Dr. Gilchrist was given in the first part of "Descriptions of South African Sponges." The circular flat under surface of the hemisphere had a satiny smoothness, and was surrounded by a fringe of spicules (oxeas and protriænes). Some species of *Tetilla* (T. polyara, T. euplocamus) are spherical or ellipsoidal and provided with a tuft of anchoring spicules; others, again, are spherical and free or hemispherical and fixed.

## EXPLANATION OF PLATE.

---

Fig. 1. *Microscleroderma hirsutum*, sp. n. $\frac{1}{3}$ natural size.
- 1*a*. Outer or poral surface. Natural size.
- 1*b*. Section, × 3.
- 1*c*. Two monocrepid desmas, × 100.
- 1*d*. Oxea, × 100.
- 1*e*. Sigmaspires, × 700. (The terminal thickenings do not really exist, and disappear on focussing).

Fig. 2. *Discodermia natalensis*, sp. n. $\frac{2}{3}$ natural size.
- 2*a*. Outer or poral surface, × 80.
- 2*b*. Inner or oscular, × 80.
- 2*c*. Phyllotriæne of poral surface, × 100.
- 2*d*, *e*. Discotriænes of oscular surface, × 100.
- 2*f*. Small tyle, × 420.
- 2*g*. Oxea, × 420.
- 2*h*. Style, × 420.
- 2*j*. Microxea, × 700.
- 2*k*. Microstrongyles, × 700.

Fig. 3. *Discodermia natalensis*, a much worn specimen. $\frac{2}{3}$ natural size.
- 3*a*, *b*. Tetracrepid desmas, × 100.
- 3*c*. Style, × 100.
- 3*d*. Microstrongyles, × 700.

Fig. 4. Section of wall of specimen drawn in Fig. 3, slightly enlarged, showing a patch (lighter in shading) of *Triptolemus incertus*, sp. n., in the midst of the Lithistid skeleton of the *Discodermia*.

Figs. 4*a*-*d*. Centrotriænes, × 100.
- 4*e*. Microxea, × 100.
- 4*f*. Metaster, × 1625.

Fig. 5. *Lithobactrum forte.* ½ natural size.
5*a*. Vertical section showing in-current and ex-current canals. Natural size.
5*b*. Section of skeleton showing canals.
5*c-f*. Monocrepid desmas, × 100.
5*g*. Amphityle, × 420.

Fig. 6. *Monanthus plumosus* in *Pachastrella*, var. *tubulatus*. ⅔ natural size.
6*a*. Section of the same. ⅔ natural size.
6*b*. Part of an oscular tube, slightly magnified.
6*c*. Monocrepid desma, × 100.
6*d*. Oxea, × 100.
6*e*. Style, × 100.

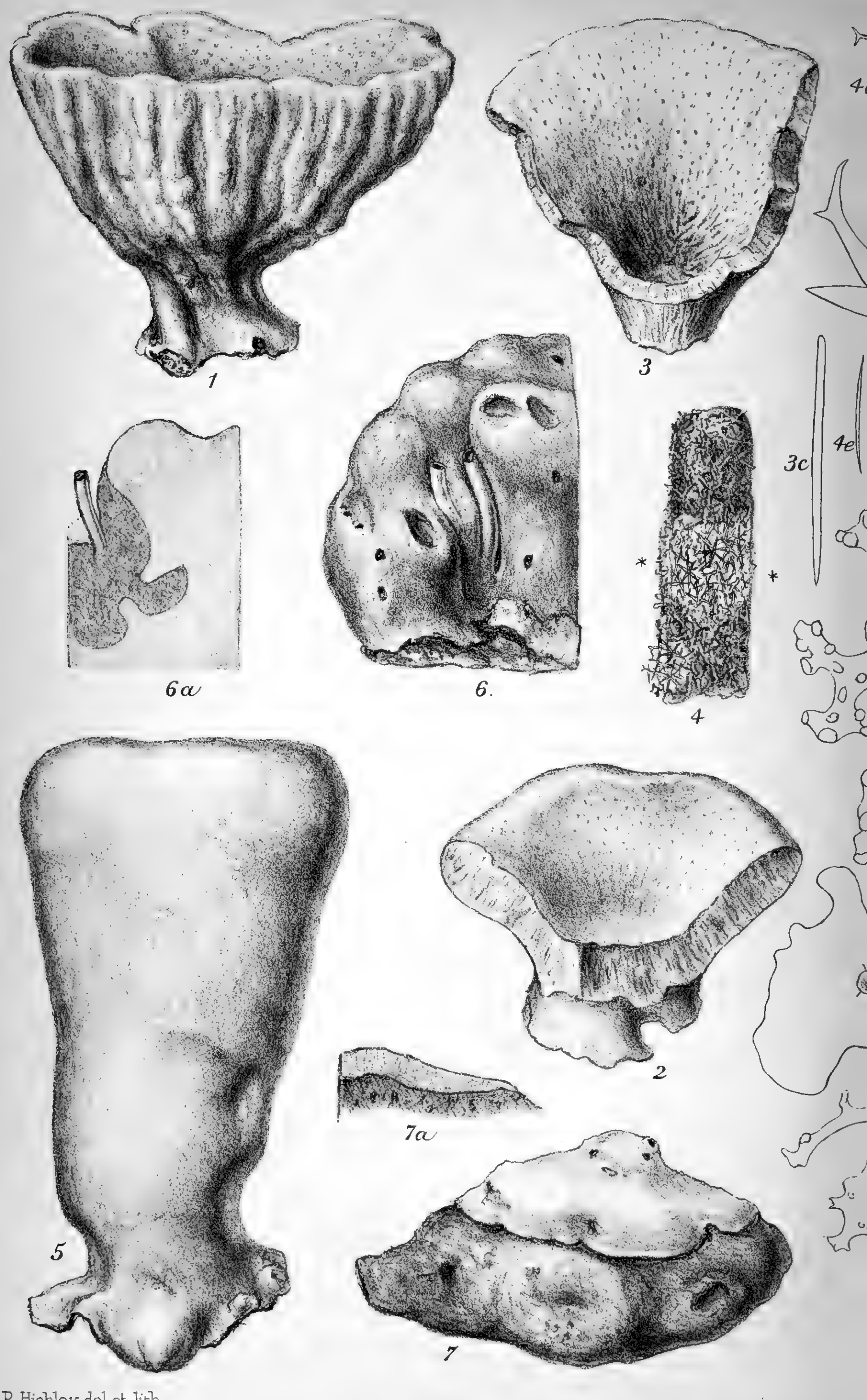
Fig. 7. *Monanthus plumosus* on *Pachastrella*, sp. n. ⅔ natural size.
7*a*. Vertical section. ⅔ natural size.
7*b*. (At lower right corner of plate) a slender oxea from the dermal membrane, × 100 (very probably foreign).*

---

* NOTE.—The fact that the variety is designated as fig. 6 and the type as fig 7, while only the spicules of the var. are figured, is due to the discovery of a second specimen of the "type" leading to an alteration of the author's views after the plate had been printed off.

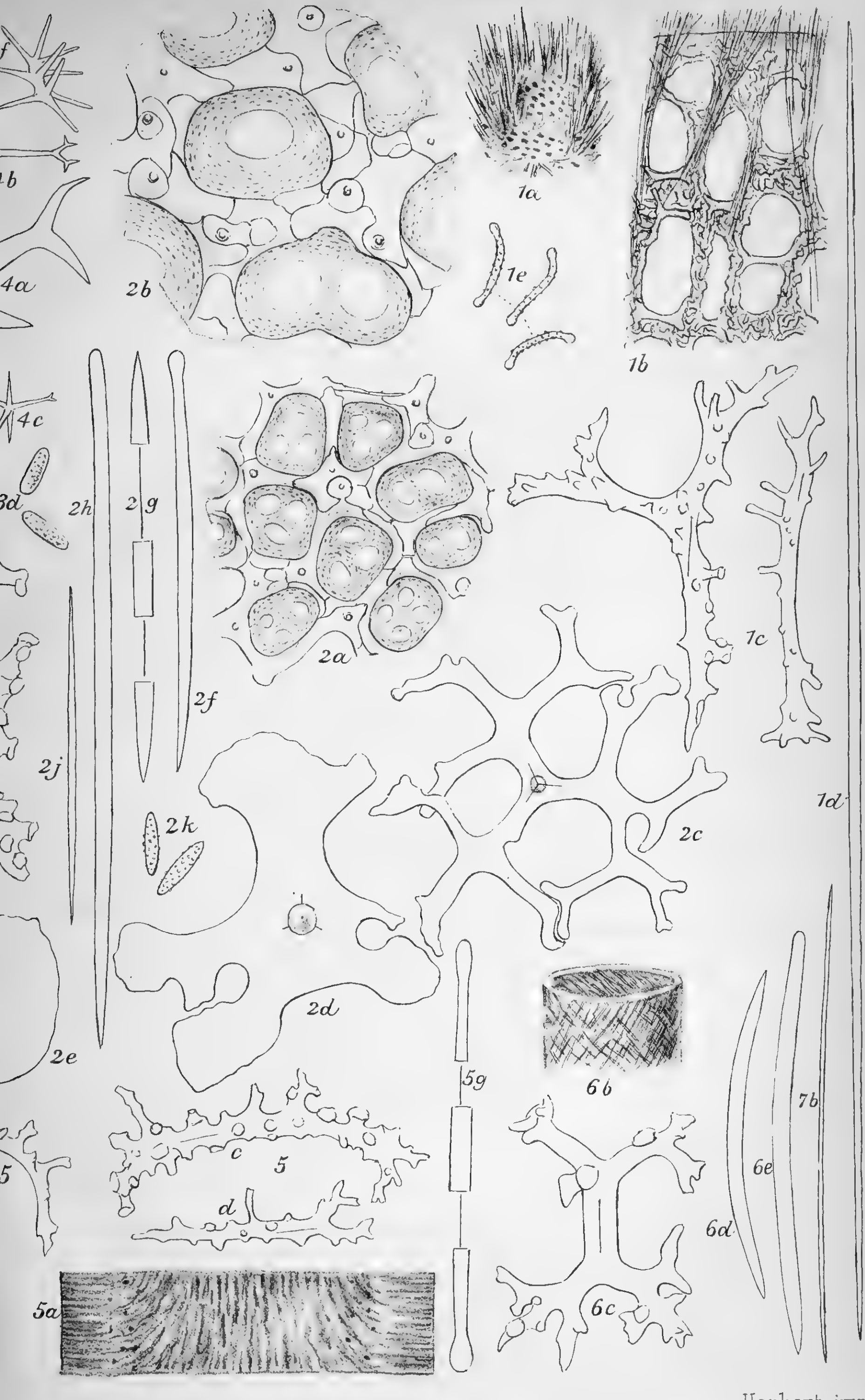
---

[Published 27th May, 1903].



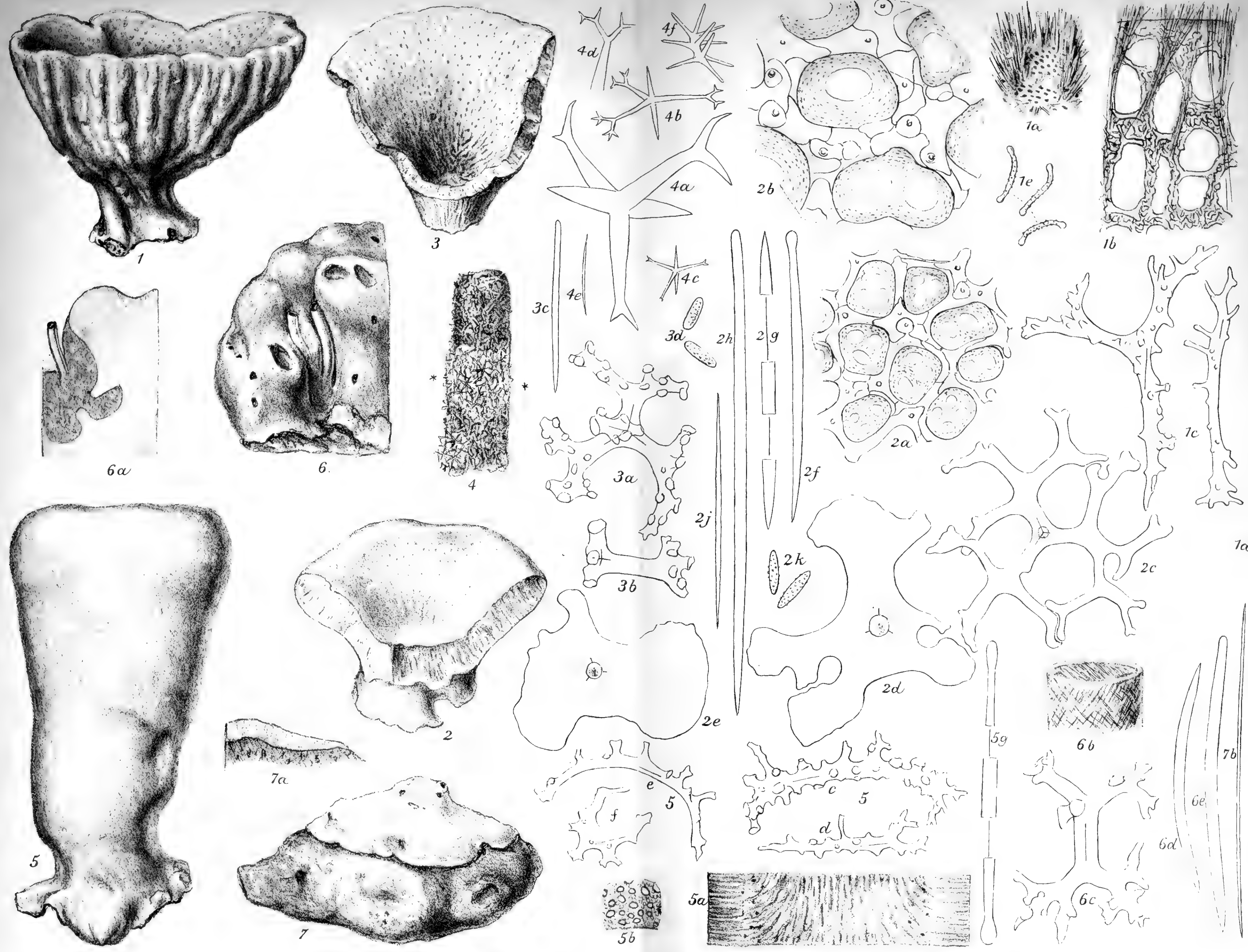

P. Highley del et. lith.

South A




Hanhart imp.

Sponges.




P. Highley del et lith.

Hanhart imp.

South African Sponges.

# THE DEVELOPMENT

OF

# SOUTH AFRICAN FISHES.

## PART I.

BY

J. D. F. GILCHRIST, M.A., B.Sc., Ph.D.,
Government Biologist to the Colony of the Cape of Good Hope.

---

The following is a first contribution to our knowledge of the development of a few of the commoner Cape fishes. It is more of the nature of a preliminary report than an exhaustive account, and it would have been well for some reasons to delay publication until time and opportunity were available to go into the matter in more detail. For practical reasons, however, it may be preferable to review the information that has now been procured on some points. These practical reasons are the differences of opinion, involving considerable difficulty in legislative matters, as to the nature of the eggs and spawn of the common fish. Thus it is commonly alleged that the practice of netting, as carried on in the Zwartkops, the Buffalo, and other tidal rivers of South Africa, has proved destructive to the eggs and spawn of fish, those of this opinion asserting with confidence that quantities of fish spawn are brought on shore by the net and left to perish. Another occasion on which the same question arose was on the commencement of trawling in False Bay, and on the Agulhas Bank, near Mossel Bay by the Government Steamer. It was thought that the dragging of the net along the bottom of the sea caused the destruction of great quantities of the eggs and young of food fishes. The Cape fishermen, an observant and intelligent class of men, were of opinion that the fish

supply was being seriously endangered by such operations, and the question was felt to be so serious that a Commission of Parliament was appointed to enquire into the matter. The evidence seemed to indicate that many of the common fishes may deposit their eggs on the bottom of the sea. Thus one fisherman, who had had an experience of a life time in fishery matters in False Bay, was of opinion that all fish spawn was on the ground, and that the trawl runs across it, and must destroy it (*vide* Report of Select Committee, p. 13). Another equally experienced fisherman thought, however, that the spawn floats on the surface (p. 18). A fisherman of fifteen years experience at Kalk Bay could not agree with this (p. 21), while another was of opinion that the eggs floated, and could be taken up in the hands out of the water. A practical fisherman of forty-three years' experience considered that the spawn is on the ground, and also floats, adding the additional interesting information: "I have seen the spawn—whether of fish or not I cannot say, but it is alive—little round things like eggs, and they smell very nasty, like rotten pumpkins. I have seen it a foot thick on the water" (p. 24). Yet another witness thought that "the fish breed on the ground, but the spawn does not stop at the bottom." Another practical man gave evidence to the effect that the klip-fish deposits its spawn on the seaweed, and it is there destroyed by the trawl (p. 37). On the other hand, in all the instances where the mature eggs had been procured and successfully fertilized on the Government steamer, the "*Pieter Faure*," they were found to float on the surface of the water, and only after the larvae had been hatched out some time did they begin to sink to the bottom. It was also brought to the notice of the Commission that it had already been demonstrated in Northern waters that there was only one fish of practical economic importance depositing its eggs on the bottom (the herring), and only a small species of herring (*Clupea ocellata*), of little value to the present fishermen, occurs in the Cape seas. On the whole it was felt very necessary that further enquiries should be made into the subject and definite information obtained. Recently facilities have been afforded by Government for more careful examination on shore of the eggs and larvae procured by means of fine nets and from the mature fish, and the following is a review of some of the most important results.

The eggs and larvae of the following fish are dealt with :

| | | |
|---|---|---|
| Chrysophrys globiceps, C. & V. | ... | White Stumpnose, p. 183. |
| „ gibbiceps, C. & V. | ... | Red Stumpnose, p. 187. |
| Dentex argyrozona, C. & V. | ... | Silver Fish, p. 188. |
| Pagellus mormyrus, Linn. ... | ... | Zeverrim or Zee-basje, p. 188. |

| | | |
|---|---|---|
| Agriopus verrucosus, C. & V. | ... | Horse Fish, p. 189. |
| Trigla kumu, Less. ... ... | ... | Red Gurnard, p. 190. |
| Sciæna aquila, Risso. ... | ... | Kabeljaauw, p. 191. |
| Clinus superciliosus, Linn.... | ... | Klip-fish. |
| „ capensis, C. & V. ... | ... | „ |
| Synaptura pectoralis, Kaup. | ... | Sole, p. 193. |
| Achirus capensis, Kaup. ... | ... | „ p. 191. |

The ova and larvae of fish as yet unknown are also described. These, designated Species I-XI, were found in fair abundance in tow nettings, and two (sp. I & II) were found in dredging, being attached to shells and rocks. One species (XI) was procured in the dredge and consisted of a cluster of eggs perhaps demersal. With the exception of these last three all the eggs examined were found to be pelagic or floating eggs.

Only two instances among the teleostean fishes have been found in which the young is brought forth alive. This is the case in two species of Klip-fish (*Clinus superciliosus* and *Clinus capensis*).*

### FAM. SPARIDAE.

## CHRYSOPHRYS GLOBICEPS. C. & V. (WHITE STUMPNOSE).

The development of this fish may be taken to represent a typical example of a free floating egg giving rise to a pelagic larval form. For this reason it is here treated in a little more detail than is necessary for specialistic purposes.

The fish is one of the commonest of Cape fishes, and is readily procured by the trawl. In November and December abundance of ripe eggs can be got from mature females, but the mature males have always been found in much greater numbers. With some practice the males and females can be readily distinguished as they come on deck, the males being of a somewhat darker steel blue colour than the females. A more definite mark of distinction, which has not yet been found to fail, is that the region between the ventral fins is white in the case of the females and blue in the male. As a rule also the profile of the head region rises much more abruptly from the end of the snout in the male than in the female, and there is usually present in the former a blue patch in this region between the end of the snout and the eyes.

* Note.—This fact was known for the first-named species as early as the time of Bloch.

The ripe eggs are transparent objects, perfectly spherical, and float freely in the water. If left undisturbed they slowly rise to the surface and remain there. Any slight movement of the water, however, causes them to move away from the surface. It is possible that the spawn described by Mr. Trouwbridge in his evidence before the Commission of 1898 may have been some such floating eggs.

The majority of the eggs (Plate I, figs 1-7) do not vary much in diameter. Out of 50, of a number taken from a female 34 inches in length, 17 were ·89 millimetres in diameter (the maximum), one was ·85 (the minimum), the average being ·88.

The surface of the eggs when examined with a high power of the microscope shows usually a series of short cross striations. The yolk itself is clear, and a layer of protoplasm may usually be seen at its periphery (fig. 1); this may become heaped up in the form of a typical germinal disc, though no fertilization has taken place, as shown in fig. 2. If not fertilized by the spermatozoa from the male, howevei, the yolk in a few hours begins to disintegrate, and the whole egg slowly sinks to the bottom.

The yolk contains one oil globule which presents great uniformity in size, being ·17 millim. in diameter. This oil globule moves about freely in the yolk, as can readily be ascertained by rolling the egg along a slide under the microscope.

Fertilization, which in nature is left more or less to chance, may be readily ensured by procuring the milt from the male and mixing it in the same jar of water with the ova. Ova of the White Stumpnose treated in this way soon shows a segregation of the protoplasm to one point, and this mass then becomes divided into two. Subsequently each of these segments become divided again into two, and this is repeated till the whole mass is a collection of small divisions. Fig. 3 shows the general aspect of a fertilized egg in which the germinal mass is divided into about 32 parts, and figs. 4 and 5 show a still later stage in which division has proceeded further, and the germinal disc begins to spread out over the yolk. Fig. 4 is a lateral view like fig. 3; fig. 5 shows the same egg as it normally comes to rest when left to float freely in the water; the heavier germinal disc being lowest, and the movable oil globule, of less specific gravity, being uppermost, a ventral view is thus presented of the segmenting mass. This process does not proceed with the same rapidity even among eggs fertilized together. Thus when some of the eggs presented the

two cell aspect others showed four divisions, and in a few traces of still further divisions were perceptible. Temperature also has much to do with the rapidity of development.

The formation of the "segmentation cavity" which appeared in about two hours after fertilization, and the growth of the germinal disc over the yolk need not here be described in detail. It need only be mentioned that in about ten hours the gastrula or expanding mass has spread well over the yolk, its thickened rim being beyond the equatorial region. An hour later the first traces of the embryo were seen when this thickened rim was $\frac{3}{4}$ over the yolk, and about an hour and a half after this the first traces of the eyes appeared at one end of the developing embryo, and at the other a small clear spot (Kupffer's vesicle). At this stage the blastopore has closed and the first segmentations of the body of the embryo have appeared. Figs. 6 and 7 represent a lateral and ventral view of a slightly later stage in which the segmentations of the body have increased in number, Kupffer's vesicle has disappeared, and spots of pigment are to be seen on the body of the embryo. A characteristic feature of this egg seems to be the temporary appearance of several spots on the yolk between the oil globule and the tail (*vide* fig. 7). These disappear completely soon afterwards. In $49\frac{1}{2}$ hours after fertilization the embryos began to hatch out, and six hours later most had hatched out and were very active. The mean temperature from fertilization to hatching was 65° Fahr. Fig. 8 represents one of the fish just after emerging from the egg. It was 2·5 millimetres in length and ·8 mm. in greatest depth, including the yolk. The front margin of the yolk falls under or slightly in front of the end of the snout. The yolk is slightly oval, being ·8 mm. in length and ·6 mm. in depth. Immediately behind the yolk is the descending part of the digestion tract. It curves slightly backwards, opening in a small indentation ventrally a little further back, at a distance from the yolk about $\frac{1}{2}$ the diameter of the oil globule. The oil globule is about the same size as in the egg, though drawn out slightly in a dorso-ventral direction. It is now fixed, and occupies the posterior angle of the yolk sac. The notochord is multi-columnar. The pigment cells, which begin to appear in the embryo at an early stage (about two days after fertilization) as small spots, yellow (by reflected light) and scattered irregularly along the side of the head and body, being absent from tail yolk and oil globule, have after the hatching process arranged themselves in a more definite manner as follows: Yellow pigment cells with many branchings on the head chiefly behind and on or in front of eyes. Above and below the body over the centre of the yolk there is a branching cell,

sometimes two. Further back over the rectum one occurs on the dorsal side of the body, and another on the ventral side, in the angle formed by the rectum and the caudal region of the body. Another two in corresponding positions, being above and below the body and sending branchings over towards each other, occur further back, between the anus and the extremity of the tail. The oil globule is covered with densely reticulated pigment cells. A few black dots occur irregularly on the body and head region. The three principal patches of yellow colour, viz., on the head, middle and caudal regions, are readily made out by the naked eye in the newly hatched larva, which soon becomes very active, and when a number are crowded together at the side of a jar they bear a striking resemblance in motion and appearance to copepods. It is possible that these yellow pigment spots, characteristic of many pelagic larva, may be a case of protective mimicry.

On the second day after hatching the yolk has greatly diminished and the larva has increased in size, as shown in fig. 9, which represents an embryo of about this age, but from a different hatching, and is selected to illustrate differences in arrangement of pigment in detail, and a difference sometimes observed in the position of the oil globule, which is here situated further forward. Further development is in the direction of the formation of the mouth, which is very apparent on the 4th day after hatching. On the 5th day a change has occurred in the head region. The anterior of the dorsal fin ascends somewhat more abruptly from the top of the head. This is still more marked on the 6th day after hatching (fig. 10). About this time the larva began to die off, and shortly afterwards only one was left. From the 7th to the 9th day after hatching a gradual change appeared in the anterior part of the dorsal fin, consisting of an indentation of the margin in the vertical from the centre of the visceral region. No increase in size was observed from the 7th day and the larvae died, apparently for want of suitable nourishment.

Some changes were noticed in the colouration on the 7th day after hatching. The yellow pigment cells were better defined in outline and position and were more branched. New black pigment patches appeared at the anal opening at its anterior margin (fig. 10) and a black tract between the digestion canal and the body, extending backwards, though much fainter, to half-way between the yellow caudal spot and the end of the tail.

## CHRYSOPHRYS GIBBICEPS, C. & V. (RED STUMPNOSE).

The male can as a rule be distinguished from the female by the greater prominence of the frontal region. Exceptional cases are, however, met with where this feature is absent in the male, and others in which it is highly developed, the head projecting considerably beyond the vertical from the end of the snout.

The egg resembles that of the White Stumpnose in size and in having only one oil globule. Of 50 eggs, from a number taken in November from a female 39 inches in length, 20 measured ·85 mm. which was also the mean, one ·88 and one ·82 mm. The oil globule measured very uniformly ·19 mm. It appears therefore this egg may be distinguished from that of *C. gibbiceps.* The diameter is not sufficiently diagnostic, but taken along with that of the oil globule the specific determination could always be made with considerable confidence. Fig. 11 represents an egg $7\frac{1}{2}$ hours after fertilization, and fig. 12 a stage about 12 hours later, showing the embryo well developed. The embryo (fig. 13) after hatching (which commenced 2 days and 3 hours after fertilization) can be distinguished from that of the White Stumpnose at the same stage. The rectum is somewhat further removed from the yolk, perhaps, however, a sign of a further stage of development, for the embryo seems to hatch out at different stages of growth. The oil globule is as a rule situated further forward than in the *C. globiceps,* but is occasionally in a more posterior position. The origin of the dorsal is also different. The colour, which is the chief distinguishing feature, is as follows: Yellow spots: One to three behind the head, between the eye and the otocyst, one on the body over centre of yolk, one at the angle between the body and the posterior margin of the yolk in front of rectum (in *C. globiceps* there was one behind), one superior to the latter on the body, one (sometimes two or more) on inferior caudal region of body. Two, one above and the other below, sending out branches towards each other over the trunk, as in the case of the *C. globiceps,* were never observed in *C gibbiceps.* Dark spots: There are dark stellate somewhat faint pigment spots on the head and extending along the dorsal side of body. At a later stage a few black dots had appeared on the ventral surface of the caudal region. The notochord is multicolumnar.

FAM. PRISTIPOMATIDAE.

## DENTEX ARGYROZONA. C. & V. (SILVER FISH).

The maximum diameter of 50 eggs examined was ·89 mm.; the minimum ·83. Most of the eggs ($\frac{3}{4}$ths) showed distinct cross markings on the zona radiata. Of the eggs examined those with weakly marked striae were all under the average in diameter. All striae became fainter as development proceeded. Yolk clear, one dark oil globule ·2 mm. in diameter.

The following will illustrate the rate of development at a temperature of 75° Fahr. and may be compared with the previous cases at 65° Fahr. Fertilized at 11-55 a.m. 16th December :—

| | |
|---|---|
| Germinal cavity appeared ... ... ... | 10.45 p.m. |
| Blastopore closed ... ... ... ... | 6.15 a.m. |
| Kupffer's vesicle appeared ... ... ... | 7 a.m. |
| Pigment cells appeared on body ... ... | 2.30 p.m. |
| „ „ „ on oil globule ... | 4 p.m. |
| Otocyst and movement of embryo ... ... | 4.35 p.m. |
| Two per cent. of eggs hatched ... ... | 9.30 p.m. |

Colour of larva : greenish yellow pigment behind the eye and slight spots of the same colour on the dorsal aspect of the trunk, posterior angle of rectum and posterior of yolk sac at oil globule. Black pigment : slight traces appear between rectum and end of tail under the body. Dorsal and ventral fin without colour. The larva is on the whole characterised by feeble development of pigment. In general shape it resembles that of the White Stumpnose, the anus, however, being about half way between tip of snout and end of the tail. The oil globule is postero-ventral. The anterior margin of the yolk sac is in about the same vertical as the end of the snout, sometimes in front, sometimes behind.

FAM. SPARIDAE.

## PAGELLUS MORMYRUS. LINN. (ZEVERRIM OR ZEE-BASJE).

The diameter of ten eggs was ·88 mm., oil globule ·16 mm. Fertilized 11.15 a.m. 15th January, 1900, (76° Fahr); at 6 p.m. germinal cavity appeared; at 9-20 p.m. the blastopore

was closing up, its thickened rim being half way between equator and lower pole and traces of the embryonic shield were to be seen. At 10.30 p.m. the optic vesicule appeared, and at 11.35 p.m. the blastopore had closed, and by midnight the embryo extended over half the hemisphere of the yolk At 6 a.m. a number of yellow and black spots appeared all over the embryo with, however, fewer on head region ; the periphery of the oil globule appeared darker, and a few (1-4) branching pigment cells occurred on it. The eggs seemed to be of a greater specific gravity than those of the White Stumpnose, as when disturbed they ascended to the surface more slowly, and very slight motion was sufficient to send them to the bottom of the jar. At 11 a.m. a considerable part of the tail was free from the yolk, large branching pigment cells were seen behind the optic vesicle and small ones in front. Two large yellow cells with branchings over the body appeared at each side of the trunk a little behind the otocyst, and others about the middle of the body. Notochord multicolumnar.

At noon there were few at the surface, most being scattered throughout the water, at 2 p.m. only one or two on the surface, about 6 in mid water and the rest, over 100, at the bottom.

Hatching out took place at 4 p.m. The embryo had a rather long yolk sac projecting slightly beyond the snout and ending posteriorly about midway between snout and extremity of tail. There is no aggregation of pigment at any particular points, but it is scattered sparsely over the whole larva in dots and stellate pigment cells, sometimes extending on to dorsal and anal fin.

The oil globule is generally postero-ventral.

## FAM. TRIGLIDAE.

## AGRIOPUS VERRUCOSUS, C. & V. (HORSE FISH).

Repeated attempts were made to secure the egg of this peculiar fish, but only on one occasion were apparently ripe samples procured from a female 9½ inches long. Agriopus is not uncommonly got in the trawl, but a ripe male and female were never got at the same time.

The egg is large, 1·7 mm. to 1·53 mm. in diameter. No oil globule is present and the surface of the egg is covered by network of well marked striations.

## TRIGLA KUMA. LESS. (RED GURNARD).

Mature males and females were procured in False Bay in December and artificial fertilization secured. The egg (Plate I, fig 14) is large. Of 30 which were measured the mean diameter was 1·2 mm., the maximum 1·21, and the minimum 1·07. The oil globule was uniformly ·23 mm. in diameter and was dark round the edges. The yolk soon becomes covered by a network of yellow and black stellate cells.

Hatching commenced on the 16th December at 2-30 p.m. of eggs fertilized on the 13th at 9-30 a.m. The mean temperature was about 65° Fahr.

The colouring of the larva (fig. 15) is very marked. Yellow stellate cells occur on the head and dorsal regions of body and on the dorsal and ventral aspect of the caudal region, but are absent towards the posterior extremity. The dorsal and ventral fins are characteristically pigmented, there being a series of stellate cells yellow and black just within the margin proceeding from the anterior end in each, and running parallel with, but not touching the border, and ceasing at a point a little anterior to the ending of the dark pigment matter which occurs on the superior and inferior border of the body. The whole yolk is covered with a close network of stellate cells, chiefly yellow, but a few black.

This agrees very closely with McIntosh's description of the first day's larva of *Trigla gurnardus,* but the pectoral fin, though appearing at this stage, is not so well developed, and is entirely destitute of pigment.

The oil globule is also similar, having a thick layer of protoplasm surrounding it, but its position is different, being well in advance of the posterior angle, the position in *T. gurnardus.*

The notochord is multicolumnar. The dorsal fin commences behind the head, and the pigment spots on the dorsal fin extend here to body. On the second day after hatching the pectoral fin is larger (about $\frac{2}{5}$ the diameter of the eye and less than double the otocyst.) The pigment cells have become more marked and ramified.

### FAM. SCIAENIDAE.

## SCIAENA AQUILA. RISSO. (KABELJAAUW).

The mean diameter of 100 ova (in formalin*) was ·88 mm. The maximum was ·91 (one specimen), the minimum ·82. There is usually one rather large oil globule ·2 mm. in diameter, but 11 out of 100 had two oil globules of a smaller size.

This egg cannot be distinguished from that of the White Stumpnose by its size, the mean diameter of each being the same, but the diameter of the oil globule is markedly different, being ·2 mm. as against ·17 mm. in the case of the White Stumpnose.

### FAM. PLEURONECTIDAE.

## ACHIRUS CAPENSIS. KAUP. (SOLE).

Specimens of this small sole are procurable in fair abundance in False Bay, and females, which may usually be readily distinguished from males by the well developed ovaries, were not uncommon in the months of November and December. The males were always procured in fewer numbers than the females. Artificial fertilization was repeatedly attempted, but was not successful. No visible spermatic fluid could be secured, and the testes were cut up and shaken in the jar containing unfertilized ripe eggs. In some instances these testes were first examined under the microscope and active spermatozoa were found. At first development seemed normal, and the protoplasm became heaped up in a germinal disc in the usual manner, but no subsequent division took place. On the following day the eggs, which had been floating at the surface, were found to have sunk to the bottom of the jar and to be in a decaying condition. It is possible that the unknown larva (Sp. V) hatched out from an egg (·98 mm.) procured in tow-nettings about the same time, was the young of this fish.

---

*A weak solution of formalin does not alter to any great extent the diameter Some eggs of the White Stumpnose were measured before and after being in formalin (four weeks) and were found to be practically the same for diagnostic purposes.

The egg (Plate I, fig. 16) has fairly well developed characteristics, being large, destitute of an oil globule, and with a series of striations and spots on its surface. It is also characterized by a cluster of clear thread-like markings as if hanging in a loose network from the under-side of the germinal disc down nearly half way into the yolk.

The mature females were found to vary considerably in size, and a good opportunity was afforded of ascertaining the relation, if any, between the size of the egg and the size of the female. Thus in one haul three perfectly ripe females were procured measuring 146, 117, and 96 millimetres respectively. The diameters of 25 eggs from each were determined with the following results.—

| | | | |
|---|---|---|---|
| Length of female ... ... | 146 mm. | 117 mm. | 96 mm. |
| Average diameter of 25 ova. | 97 ,, | ·94 ,, | ·93 ,, |
| Maximum ,, ,, ,, ... | ·98 ,, | ·96 ,, | 1·02 ,, |
| Minimum ,, ,, ,, ... | ·94 ,, | ·91 ,, | ·91 ,, |

With the exception of the maximum and minimum of the eggs of the smallest specimen this table shows a distinct proportion between the size of the egg and that of the parent. The maximum in this particular case is greater than the maximum of the largest specimen, and the minimum equals that of the 2nd largest. An examination of the actual measurements, however, in a manner explains this. The measurements were taken of the first 25 without selection, and as only one single egg was found of this very large size (1·02 mm.), it may perhaps be regarded as abnormal. The next largest egg was ·95 mm., which would be the usual proportion, and in glancing through about 100 this large egg was very distinctly of an exceptional size. As, however, it appeared of perfectly normal structure and in perfectly normal condition it was not rejected. The minimum (·91) of the smallest specimen also does not represent the actual proportions, as in the 2nd largest specimen, which has the same minimum, there was only one of this size, while in the smallest specimen there were four. There is certainly evidence from these measurements indicating a general relation between the size of ova and parent.

An opportunity was afforded on another occasion of measuring 100 eggs of another specimen of Achirus of a normal size, about that of the largest specimen mentioned above. The average size was ·97 mm. and they ranged from ·99 to ·94. Fertilization was attempted at 12.10 p.m. by shaking up teased testes among the ripe eggs, but by 6 p.m. they showed distinct signs of disintegration, and most had left the surface and lay on the bottom of the jar.

## SYNAPTURA PECTORALIS, KAUP. (SOLE).

The mean diameter of 100 ova (in formalin) was ·8 mm., the maximum ·81 (3), the minimum ·72 (1).

The small size of the egg readily distinguishes it from the others, and it can at once be determined by the presence of a number of oil globules from one (rare) to twelve in number, and varying in size from ·04 to ·15 mm. Fertilization was readily secured on board the "*Pieter Faure*," and the larva kept alive 241 hours.

A description of the larva of this fish and of others preserved in formalin is deferred until fresh material and opportunity for further examination is afforded.

## EGGS AND LARVAE OF UNKNOWN FISH.

### SPECIES I.

(DEMERSAL.)

Several clusters of this egg were found in dredging on shells and stony ground in False Bay in November and December, as follows :—

| Date. | Locality. | Depth (fms.) | Bottom. | Occurrence. |
|---|---|---|---|---|
| 12.11.02 | W. of Seal Isl. (False Bay) | 16 | Sand and shells. | In shell of Patella. |
| 19.11.02 | S. of Seal Isl. (False Bay) | 11 | Broken shells. | In shell of bivalve. |
| 25.11.02 | False Bay | 10 | Fine sand. | In shell of bivalve. |
| 26.11.02 | False Bay | 9 | Broken shells. | On stone. |
| 12.12.02 | W. of Seal Isl. (False Bay). | 19 | Broken shells. | On stone. (Pl. II, fig. 17) |

The first lot was just on the point of hatching when procured and nearly the whole hatched out. Macroscopically these eggs presented the appearance of small globules of a semi-transparent gelatinous substance, with the exception of two minute black spots, the eyes of the developing embryo. Those procured on the 19th showed an earlier stage, being entirely destitute of pigment. There were about 500 in a bivalve shell, each about 1 mm. in diameter.

They were very firmly attached to the shell and could only with difficulty be removed without rupture. When viewed by transmitted light under the microscope they were found to be

filled with a granular mass in which were scattered many small oil globules. A dividing mass of protoplasm at about the 8 cell stage was also seen. The eggs were separated from each other by a distance about equal to their own diameter, and though there was a spreading out of base of the egg capsule so that it seemed to be continuous, yet when carefully removed each individual egg came off independently of those surrounding it.

The diameter of the egg and general appearances were not of course sufficient to identify these two lots of eggs, and as development proceeded in the younger lot appearances presented seemed to indicate that they belonged to a different fish. Three days after the egg was procured two thin black parallel streaks appeared near the periphery of the egg at one side, and these proved to be lines of black pigment running along each side of the body of the embryo. Ten days after this a marked difference was observed, the lines of pigment, which were found to have apparently converged posteriorly and become one on the ventral caudal region, began to break up into stellate black pigment cells. This process was accompanied by the appearance of branchings of the black pigment into the surrounding tissue. Plate II, fig. 18 is from a photograph (by transmitted light) of an embryo at this stage. Branchings are seen from the lateral pigment line, and the ventral caudal streak is becoming broken up. Fig. 19 is from a photograph of the eggs containing embryos at a somewhat later stage of development. They were photograped in situ attached to a stone (therefore by reflected light) and show various stages in this process from the two continuous black tracts merging into one, to the condition in which these parts are broken up into spots of pigment; in these latter a few yellow pigment spots appear among the black. A number of large oil globules not observed earlier were seen in the embryos at this stage. They varied in number from one to five. They may be the result of the fusion of the minuter globules of the earlier stages. When procured the eggs showed only a few divisions of the germinal disc, and had therefore probably been newly deposited. Seventeen days afterwards the first ova hatched out. The period of development in the egg is therefore very much longer than that of any of the pelagic eggs which usually hatched out in 2 days at the same temperature.

The newly hatched embryo (Plate II, fig. 20) has therefore a totally different appearance to those which hatch earlier. The pectoral fins are well developed. The otocyst is large, extending from the posterior border of the eye to the pectoral fin. The yolk sac protrudes very little, and disppeared on the following day.

Running along each side of the body are two rows of bright yellow (by reflected light) spots, extending from the pectoral to some distance behind the vent. Black pigment spots occur in irregular longitudinal rows among the yellow spots, also on the visceral region and the anal fin just behind the vent (the only pigment on any of the fins). On the following day these spots became stellate, and the whole pigment appeared denser.

## SPECIES II.

### (DEMERSAL.)

Only on one occasion were samples of this egg procured. They were dredged on the 18th November, 1902, in False Bay (Zwart Rlip bearing North, 1½ miles; depth, 9 fms.). About 100 hatched out from 3 p.m. to 7 p.m. of the same day, but died shortly afterwards.

About 300 eggs were firmly fixed to the inside of a dead barnacle shell. They were about 1 mm. in diameter, and the adhesive membrane of one egg was slightly continuous with those surrounding it (Pl. II, fig. 21). They appeared as vivid dark blue specks about the size of a pin's head. In some the eyes could be discerned without a lens. Some eggs were not wholly blue and opaque, and showed on one side numerous oil globules occupying less than a half of the whole sphere. In others the blue yolk mass occupied one half the sphere, and the two large eyes, each a little under ¼ the diameter of the egg, lay in the other half with a clear yellow space between and on each side of them, but posteriorly they touched the blue yolk. A conspicuous feature was the heart of a reddish brown colour situated in a notch in the margin of the blue yolk between the eyes. In all the photographs taken an arborescent series of vessels was revealed radiating from the heart through the yolk. Nothing of this could be discovered in viewing the yolk through the microscope, and that it appeared in the photograph was probably due to the less actinic character of the yellow light from the blood. The circulation of the blood could be seen very distinctly at the margin of the hemisphere to the left of the embryo. It was very active, and the heart beat 104 to the minute.

The newly hatched larva (Pl. II, fig. 22) is very lively, much more so than that of Sp. I. The yolk is comparatively small, its anterior end being behind the posterior margin of the eye. Five branchial arches and the mandible of the lower jaw were well developed;

notochord multicolumnar. The long body is somewhat dark, and a few small black stellate cells appear on its ventral margin near the end of the tail. In the abdominal region the remains of the blue yolk occupy only about half the abdominal cavity, the rest being filled up with the well developed intestine. Above the intestinal mass is a tract of very dark blue pigment. There is a large transparent pectoral fin extending upwards beyond the dorsal margin of the body by about $\frac{1}{2}$ its length.* The beginning of the dorsal* is situated behind the otocyst, being separated from it by a space about equal to its diameter. The otocyst is very close to the eye.

The absence of pigment readily distinguishes it from Species I, and a reference to the figures will show marked differences in other respects, as for instance the anterior position of the anus.

## SPECIES III.

### (PELAGIC.)

About half-a-dozen unknown pelagic eggs were procured on the 20th November, 1902, in a surface tow net in False Bay. They were very large (1·7 mm. in diameter), due chiefly to the size of the perivitteline space, which was in breadth about $\frac{1}{3}$ the diameter of the yolk. The margin of the egg had a vivid green tint. One oil globule was present, relatively small, being only ·2 mm. in diameter. The embryo shows a series of small black stellate spots along the body from head to tail. There are no pigment spots yellow by reflected light. The upper part of the yolk next the embryo has a number of fine circular lines throughout its substance. (Plate III., figs. 23 and 24.)

Some were hatched out on the following day. The larva can be distinguished from others by the very elongated body (4·1 mm.). Its movements are also characteristic. Instead of the sharp wriggle of the tail there is a comparatively slow undulation of the whole body. Though there are no yellow pigment spots, by reflected light a golden tinge is apparent on the upper margin of the body in the region of the otocyst, and on the posterior margin of the yolk. There are minute black dots on the upper part of the head, and these extend backwards along the dorsal region of the body to about the vertical from the middle of the yolk, where also the dorsal fin commences A few other dark spots occur here and there on the body. The oil globule is slightly in front of the posterior angle of the yolk. The notochord is unicolumnar and the anus is situated in the posterior third of the body. (Pl. III. fig. 25).

---

* Not brought out clearly in photograph (Fig. 22).

## SPECIES IV.

### (PELAGIC.)

On one occasion an egg 1·44 mm. in diameter, and with a single oil globule ·29 mm. in diameter, was found in tow nettings in False Bay in December. The larva (Plate III, fig. 26) hatched out on the following day, and proved to be well marked as regards colouring. There was a dense network of yellow pigment along the borders of dorsal and ventral fin, and a few yellow pigment cells on the oil globule which occupied an anterior position. Isolated stellate black spots occurred on the oil globule above the head and behind it for a short distance; a series of isolated stellate black spots occurred on the ventral side of the body from otocyst to rectum, and about half a dozen on the posterior inferior margin of the yolk sac. The yolk had a vesicu ated appearance. The anus was considerably behind the yolk in the posterior half of the total length of the body.

About the same time another egg, 1·48 mm. in diameter, with an oil globule ·29 mm. in diameter was found, and produced a similar embryo.

## SPECIES V. uhi?

### (PELAGIC.)

Several eggs were procured in tow-nettings on the 16th December, 1902, from False Bay, having a diameter of ·98 mm. and possessing no oil globule. Yolk and embryo were covered with many yellow pigment cells. They hatched out into larvae (Pl. III, fig. 27) which were readily distinguished in the water by their short form and large yolk sac, and by characteristic movement, viz., a rapid vibration of the extremity of the tail with very little apparent movement of the anterior parts. They have also macroscopically a slightly cloudy appearance. The larva was 1·6 mm. in length, and the yolk sac very nearly half this. The anus was situated close to the yolk sac, and is thus near the vertical from the centre of the body.

The body, head, yolk sac and vertical fins are covered by yellow finely branching pigment cells, the bodies of which are small and bead like. An exception to this is the posterior third of the caudal region, which is destitute of any pigment. In some larvae a few of the ends of the branching cells were black, and in others a few black spots appeared on the body.

Though the usual dark oil globule was absent, about half-a-dozen very faint clear oily looking bodies were seen indistinctly in the yolk. There was no trace of a pectoral fin visible. The growth of the pectoral may be very rapid, as a very similar larva recently hatched from an unknown egg had the pectorals well developed. It is possible also that this larva may be the same, only hatched out at a later stage of development.

## SPECIES VI.

### (PELAGIC.)

An unknown larva, apparently newly hatched, was procured in a tow netting on the 12th December, 1902, in False Bay, 5 fathoms from the surface. It was 2·1 mm. in length, and possessed a single oil globule ·16 mm. in diameter and situated anteriorly. The yolk sac was rather long and oval. Along the dorsal region of the body were small black stellate pigment spots. Yellow spots, very faint, giving only a yellow tinge to the body occurred from posterior of the yolk sac towards the caudal extremity where no pigment occurs. A yellow patch occurred before and one behind the head. The oil globule is covered with yellow network of pigment. It is probable that this larva was from an egg ·81 mm. in diameter, though I have some slight doubt as to this, on account of the presence of other unknown eggs. (Pl. III, fig. 28).

## SPECIES VII.

Sole

### (PELAGIC.)

An egg 1·32 mm. in diameter, and containing many small oil globules, was found in a tow-netting from False Bay on the 16th December, 1902. Hatching occurred the following day.

The larva, including yolk sac, is covered with yellow branching pigment cells from snout to tail. A few black spots occur on the top of the head and on the mid region of body. The notochord is multicolumnar. The oil globules are scattered throughout yolk. There are about 50 of them, and they vary from ·01 to ·06 mm. in diameter. The pigment cells on dorsal and anal fins have a tufted appearance. In addition to these distinctive features the larva has a very characteristic protrusion over the head region. This, however, seems to vary, as larvae otherwise similar had this feature in a less marked degree. Pl. IV, fig. 29, is from a photograph of this larva. Another larva, very similar in appearance, but with the oil globules situated in a cluster posteriorly may belong to the same species (fig. 30); Fig. 31 is a later stage of the latter.

## SPECIES VIII.

### (PELAGIC.)

An egg 1·06 mm. in diameter containing no oil globules was found in a tow-netting from False Bay in December. It produced a long (4·5 mm.) larva of a clear hyaline appearance with no yellow spots and only a few (20) black ones, sometimes with branchings. These occurred on the top of the head and scattered without order at considerable distances from each other along the body to the caudal extremity; also one on dorsal and anal fin behind the rectum. The yolk had a clear sacculated appearance. The notochord was unicolumnar. (Pl. IV., fig. 32.) The distance between the anus and the posterior extremity was contained 5 times in the total length of the body, so that its position is markedly posterior.

The pectoral fins were slightly developed.

## SPECIES IX.

### (PELAGIC.)

A cluster of fish eggs containing embryos was procured in the shrimp trawl on the 2nd April, 1902, 47 miles North West of Lion's Head, from 175 fathoms.

The eggs were spherical, 2 mm. in diameter, and were securely agglutinated together at their points of contact in a small bunch, perhaps a fragment of a larger mass torn from the bottom or captured in the ascent of the trawl in mid water or surface. No opportunity was afforded of ascertaining to what kind of larva they belonged. They were preserved in formalin and the measurements are from these preserved specimens.

## SPECIES X.

### (PELAGIC.)

A large egg 1·78 mm. in diameter, and possessing many small oil globules, was found in a tow-netting in December in False Bay. It contained an embryo and yolk sac, both

covered with a network of branching yellow cells. The pectoral fins were distinctly visible at this stage (a day before hatching).

The newly hatched larva proved to be well marked, being readily distinguished from all others on account of its large size (4·1 mm.) and uniform pale greenish yellow colouring, which was absent only from the extremity of the tail. Examined with a low power the colouring matter is found to consist of branching black and yellow cells mixed indiscriminately.

The position also of the heart is different from that in all other larvae examined, being situated anteriorly in the space in front of the yolk sac and immediately under the posterior half of the eye. The notochord is multicolumnar.

About three days later a marked change was observed, the colour had completely disappeared from the median fins, and the body became opaque and of a dark green colour. The posterior extremity presented a bifurcate appearance macroscopically, due to the absence of the pigment in this region, and this may be a useful diagnostic character. Instead of swimming about freely in the water like the other larvae observed, this larva kept at the bottom of the jar, head downwards, the tail keeping up a constant and rapid vibration.

---

[PUBLISHED 6TH JULY, 1903.]

KEY TO EGGS AND LARVÆ OF SOME SOUTH AFRICAN FISHES.

| Oil Globule. | | Diameter of Egg. | Diameter of Oil Globule. | Occurrence. | Remarks. | Position of Oil Globule. | Position of Rectum. | Notochord. | Pigment. | Species. |
|---|---|---|---|---|---|---|---|---|---|---|
| Present. | One | 1.7 | .2 | Pelagic | Large perivitteline space | Postero ventral | Posterior | Unicolumnar | Very little | Species III. |
| | | 1.44 | .29 | ,, | Largest egg including yolk | Anterior | Median | (?) | Abundant on body and fins | ,, IV. |
| | | 1.21—1.07 | .23 | ,, | Yolk early pigmented | Ventral | Anterior | Multicolumnar | ,, | *Trigla kumu.* |
| | | .91— .82 | .2 | ,, | About 10 % have 2 oil globules | Posterior | ,, | ,, | (?) | *Sciæna aquila.* |
| | | .89— .85 | .17 | ,, | ... | ,, | ,, | ,, | Moderate, on body | *Chrysophrys globiceps.* |
| | | .89— .83 | .2 | ,, | ... | ,, | ,, | ,, | Little, on body | *Dentex argyrozona.* |
| | | .88 | .16 | ,, | ... | Ventral | ,, | ,, | Slight | *Pagellus mormyrus.* |
| | | .88— .82 | .19 | ,, | ... | Posterior | ,, | ,, | Moderate, on body | *Chrysophrys gibbiceps.* |
| | | .81 (?) | .16 (?) | ,, | ... | Anterior | ,, | ,, | Slight | Species VI. |
| | Few ... | .81— .72 | .15—.04 | ,, | From 1 (rare) to 12 oil globules | ... | ... | ... | ... | *Synaptura pectoralis.* |
| | Many | 1.78 | ... | ,, | ... | ... | ... | Multicolumnar | On all parts | Species X. |
| | | 1.32 | ... | ,, | ... | ... | ... | ... | ... | ,, VII. |
| | | 1 | ... | Demersal | Not pigmented | ... | Anterior | ... | Abundant, on body | ,, I. |
| | | 1 | ... | ,, | Dark blue in colour | ... | ,, | Multicolumnar | Very little | ,, II. |
| Absent. | ... | 2 | ... | (?) | In a cluster | ... | ... | ... | ... | ,, IX. |
| | ... | 1.7 —1.53 | ... | Pelagic | ... | ... | ... | ... | ... | *Agriopus torvus.* |
| | ... | 1.06 | ... | ,, | ... | ... | Posterior | Unicolumnar | A few spots on body | Species VIII. |
| | ... | 1.02— .91 | ... | ,, | ... | ... | ... | ... | ... | *Achirus capensis.* |
| | | .98 | ... | ,, | ... | ... | Anterior | Multicolumnar | Dense on yolk and larva | Species V. |

# EXPLANATION OF PLATES.

(All the figures have been drawn on stone from micro-photographs, and are magnified about 20 times, with the exception of Figs. 18, 19, 21 and 17, which last is natural size.)

## Plate I.

Fig. 1. Unfertilized egg of *Chrysophrys globiceps* (White Stumpnose).

" 2. Another showing formation of germinal disc.

" 3. Fertilised egg showing germinal disc divided into about 32 parts.

" 4. Later stage showing spreading out of germinal disc, side view.

" 5. The same, ventral view.

" 6 and 7. Side and ventral view of developing embryo.

" 8. Newly-hatched larva of White Stumpnose.

" 9. Larva two days later.

" 10. Larva six days later.

" 11. Fertilized egg of *Chrysophrys gibbiceps* (Red Stumpnose).

" 12. Later stage showing embryo.

" 13. Newly-hatched larva of Red Stumpnose.

" 14. Fertilized egg of *Trigla kumu* (Red Gurnard).

" 15. Newly-hatched larva of Red Gurnard.

" 16. Egg of *Achirus capensis*.

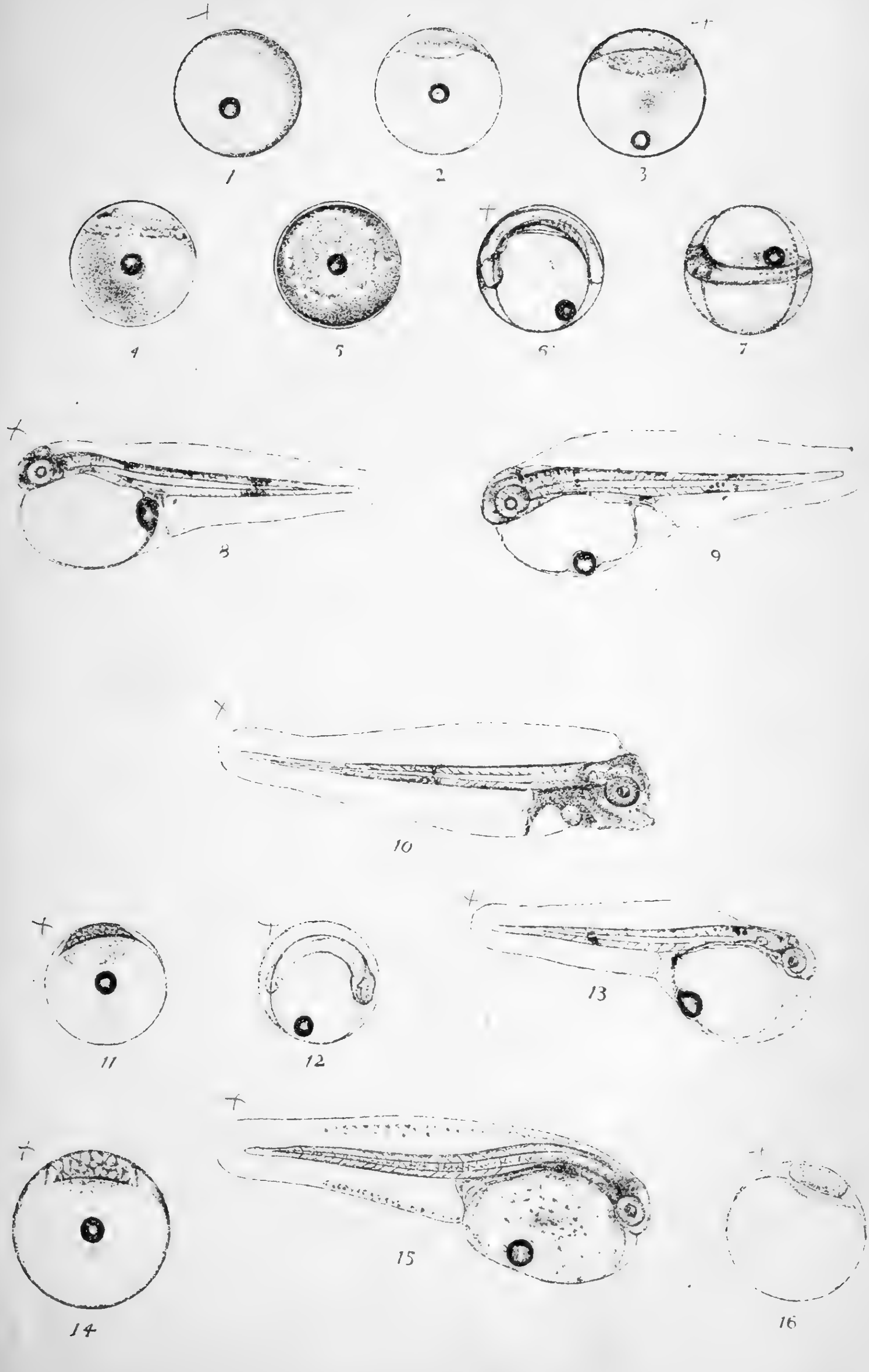

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

PLATE II.

Fig. 17. Stone on which have been deposited eggs of a fish (Species I.) (Nat. size.)

„ 18. Detached egg containing embryo, from photo by transmitted light ($\times$ 40).

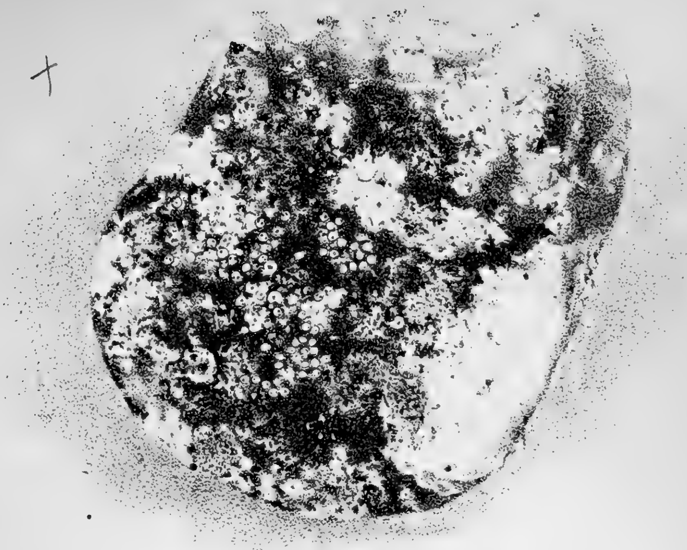
„ 19. Group of eggs containing embryos, from photo by reflected light. (The eggs are in situ on the stone.)

„ 20. Newly-hatched larva of Species I.

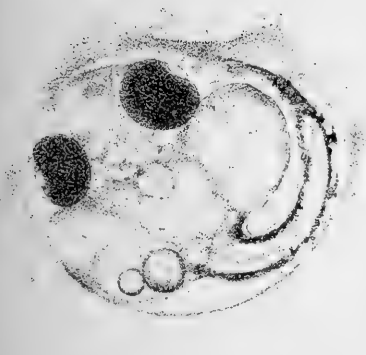
„ 21. Two eggs of Species II. detached from shell of barnacle and photographed by reflected light ($\times$ 15).

„ 22. Newly-hatched larva of Species II.

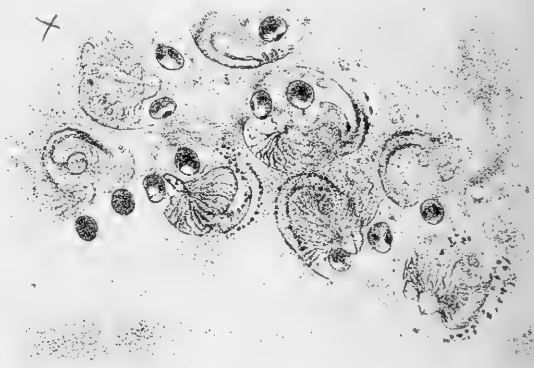
(NOTE.—The origin of the dorsal fin is not sufficiently indicated in drawing.)



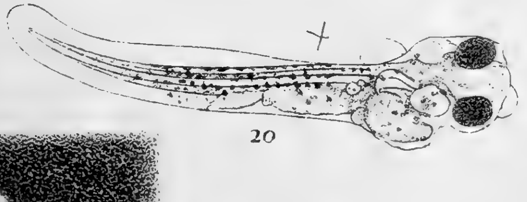
17



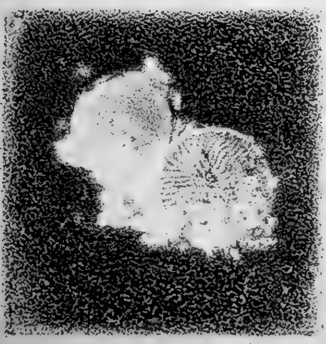
18



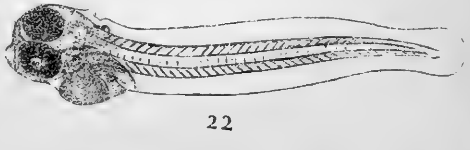
19



20



21



22

PLATE III.

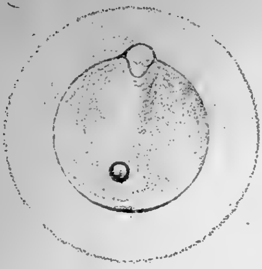
Fig. 23 and 24. Two stages of egg of Species III.

„ 25. Newly-hatched larva of Species III.

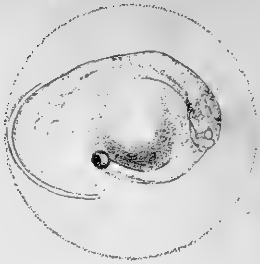
„ 26. „ „ „ IV.

„ 27. „ „ „ V.

„ 28. „ „ VI.

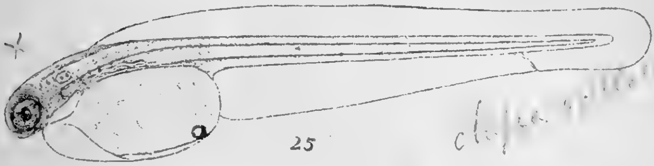


23



1·7 mm

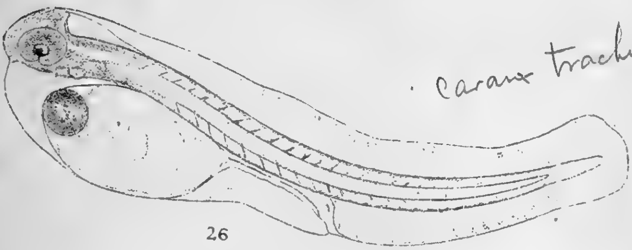
24



4·1

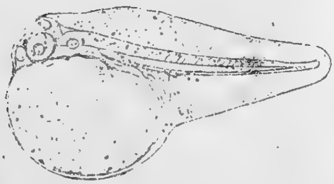
clupea

25



Caranx trachurus

26



27

2·1

28

PLATE IV.

Fig. 29. Newly-hatched larva of Species VII.

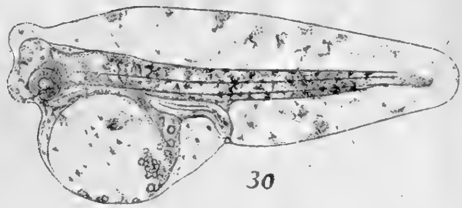
" 30. Larva very similar to Species VII.

" 31. Later stage of larva represented in fig. 30.

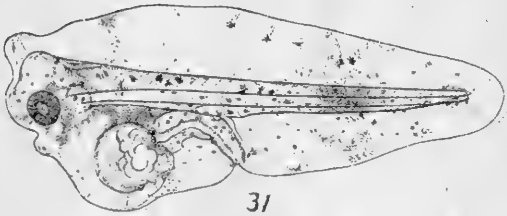
" 32. Newly-hatched larva of Species VIII.

" 33. " " " X.

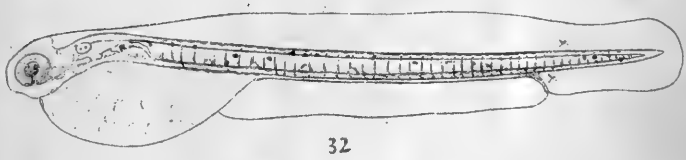
29



30

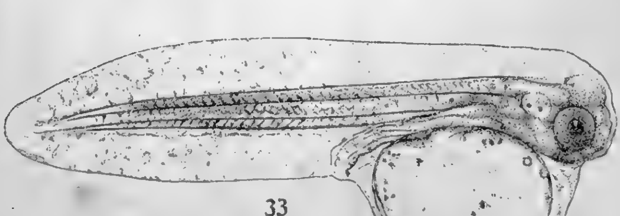


31



32

4·5



33

4·1

# DESCRIPTIONS OF NEW SOUTH AFRICAN FISHES.

BY

J. D. F. GILCHRIST, M.A., B.Sc., Ph.D.,

Government Biologist to the Colony of the Cape of Good Hope.

---

The following is a continuation of the description of new fishes procured in the course of the work of the "*Pieter Faure*" on the South African Coast. It contains an account of three new genera and four new species as follows :—

1. *Trachichthodes spinosus*, n.g. and sp.
2. *Plectromus macrophthalmus*, n.sp.
3. *Apogon queketti*, n.sp.
4. *Melanocetus rotundatus*, n.sp.
5. *Laemonemodes compressicauda*, n.g. and sp.
6. *Selachophidium guentheri*, n.g. and sp.
7. *Aphoristia variegata*, n.sp.

## Fam. **BERYCIDAE.**

### TRACHICHTHODES, n.g.

Body ovate, compressed, covered with scales of moderate size regularly arranged with longitudinal striations and strongly ctenoid ; no scutes on abdomen ; scales of lateral line not enlarged. Head large with muciferous cavities covered by thin skin with minute pores. Mouth oblique ; maxillary, which is provided with a supplemental striated plate, extends backwards behind centre of eye. Villiform teeth in jaws, vomer and palatine. Angle of operculum and preoperculum with spines. Supra scapula with serrations, no distinct spine. Branchiostegals eight, with spines on inferior exposed surface. Suboperculum with serrated edge. One dorsal, ventrals with one spine and seven soft rays. Four anal spines.

Mr. G. A. Boulenger, F.R.S., who has kindly examined this specimen along with most of the others here described, considers it a sort of connecting link between the group to which Trachichthys belongs and Myripristis.

*Trachichthodes spinosus, n.sp.*

(Plate XIII., fig. 1.)

Br. 8. D. VI 15. A. IV 15. V. I 7.

Height of body a little more than half its length (excluding caudal). Head contained $1\frac{1}{3}$ in height. Eye large, its diameter less than length of snout, and contained $2\frac{1}{2}$ times in length of head. Mouth large, the maxillary extending to slightly beyond the vertical from the centre of the eye. A supplemental striated plate on maxillary. Premaxillary with band of villiform teeth interrupted at symphysis by notch. A small triangular patch of teeth on vomer and a long narrow ridge of teeth along palatine. The mandibular is covered inferiorly with numerous spines. Spines also occur on the inferior exposed surface of the branchiostegals. There are spines on the operculum, not well marked on its posterior vertical margin, but one or two well marked spines occur at its lower angle. The preoperculum is well developed with a double margin with well developed spines at the angle of each. The suboperculum has an inferior edge of closely set spines similar to those on inferior aspect of branchiostegals. There is a small patch of scales at angle of anterior margin of preoperculum, no other scales occurring on the head region. Nostrils are wide, in front of and close to orbit. The anterior margin of the nasals is armed with small stout spines. Scales strongly ctenoid and striated. About 20 parallel longitudinal rows between 1st dorsal and inferior median line They are not enlarged at base of dorsal or anal nor along lateral line. Those at the immediate base of the dorsal are very small, about $\frac{1}{3}$ the size of the normal scale, and those at the base of the anal, while not enlarged, are somewhat more elongated in outline, with a more unequal free border. The base of the caudal is covered with small scales, which extend backwards over about $\frac{1}{3}$ of the length of the rays. The lateral line cannot be traced distinctly, though each scale in this region has a very large muciferous canal. Total length, including caudal, 80 mm.

*Locality:* The single specimen from which this description is taken was procured by dredge, Cape Morgan (on East Coast) bearing N.W. $\frac{1}{4}$ W., distant $6\frac{1}{2}$ miles; depth, 45 fathoms.

*Plectromus macrophthalmus, n.sp.*

(Plate XIII., fig. 2.)

Br. 8. D. II 11. A. I 9. V. I (II.?) 7. L. l. 39. L. tr. 7.

Height of body nearly 4 times in length. Caudal peduncle long and slender, its least height being less than $\frac{1}{3}$ of that of body. Length of head 3 times. Eye large, its diameter one half the height of the body and nearly $2\frac{1}{2}$ times in length of head. Snout about $\frac{1}{2}$ diameter of eye, rounded. Lower jaw projecting slightly beyond upper. Maxillary extends to below middle of eye. Pectorals long, reaching beyond the vent nearly to posterior end of dorsal or middle of anal, slightly longer than length of head. Ventrals reach nearly to vent. Dorsal overlaps anal, the commencement of which falls under the 7th ray of dorsal.

The body is covered with large deciduous scales, a few of which were left under the pectoral. These were large (2·4 mm. in diameter, or about half the diameter of the eye), thin and almost circular in outline. The head region was somewhat damaged, but apparently had been covered by a delicate skin with no scales. There are four suborbital glandular openings, 6 on preoperculum, 3 under mandible, and several on nape of neck extending forward to snout. The operculum has three ridges radiating from a centre. The first is directed upwards and backwards, the second horizontally backwards, and the third downwards. Between the first and second there is a series of about six smaller ridges radiating from the same centre. The tops of these and of the second ridge were found to project through the skin in the form of small spines, so that the operculum cannot be described as unarmed. There is a horizontal ridge of the shoulder girdle immediately over the base of the pectoral, but no spine. The condition of the specimen rendered it doubtful whether there are one or two spines in the ventral. Total length, including caudal, 42 mm.

In the large eye, long caudal peduncle and position of anal relatively to dorsal this species resembles *Melamphaes megalops* Lütken (*Plectromus megalops*, Goode and Bean) and apparently belongs to the same genus, but it differs from it in the oblique insertion of the dorsal and anal and the long ventrals characteristic of that species.

*Locality:* The single specimen procured was obtained by shrimp trawl, Cape Point Light-house bearing S. 83° E; distant $35\frac{1}{2}$ miles; depth, 360 fathoms.

## Fam. PERCIDAE.

### *Apogon queketti, n.sp.*

(Plate XIV.)

Br. 7. D. VII, I 8. A. II 8. L. l. 26. L. tr. 2, 6.

Length of head 3, height of body nearly $3\frac{1}{3}$ in total length. Diameter of eye 4 in length of head and equal to interocular space. Vertical border of preoperculum entire with about four large denticulations at angle and horizontal border.

Fins: spinous much lower than soft dorsal, 3rd, 4th and 5th spines the highest. Ventrals reach to the anus, slightly longer than pectorals. Caudal rounded. Total length, including caudal, 100 mm.

Colour: About seven longitudinal lines formed by dark spots. Three broad vertical bands most marked in young forms occur in the region of the body between the posterior end of the 2nd dorsal and the caudal. Head region somewhat darker than body, a dark band descending from the inferior border of the orbit. A large black patch posteriorly on the first dorsal. The edges of the second dorsal, the anal and caudal are black.

*Locality:* Seven specimens were procured off the coast of Natal. Three were got at a depth of 40 fathoms, Tugela River mouth bearing N. by W. $\frac{3}{4}$ W., distant $15\frac{1}{2}$ miles; and four with Tugela River mouth bearing N.W. by N. $\frac{3}{4}$ N., distant $15\frac{1}{2}$ miles; depth, 36 to 42 fathoms.

## Fam. PEDICULATI.

### *Melanocetus rotundatus, n.sp.*

(Plate XV.)

D. 14. A. 4. P. 19. C. 9.

Height of body (25 mm.) nearly equal to length (27 mm.) without caudal; breadth (17 mm.) nearly 1·8 in length. Distance between snout and gill opening 1·8 in length of body, the gill opening being well in front of origin of dorsal and anal, their respective distances from the snout being 15, 19·5 and 24 mm. The distance between the gill opening and caudal is less than between snout and gill opening, viz.: 12 mm. or 2·25 in the length of the body. It is equal to the interorbital width, which is broad and concave. Over the eye is a triangular bony protuberance not piercing the skin; two smaller ones occur in front of it and one behind. Nostril at anterior margin of the eye, half of which is hidden under the

black skin, the other half appearing on the margin of a circular patch of skin devoid of black pigment. Maxillary 1·8 in length of body (rather more than one half in *M. Johnsoni, Günther.*)

Teeth similar to those in *M. Johnsoni* and *M. Krechi.* Fins: The first dorsal (tentacle) is situated in the middle line behind the upper jaw; it is $\frac{1}{3}$ of the length of the body. The distance between it and the second dorsal is equal to the length of the maxillary or the breadth of the body. The first ray of the second dorsal is low (4 mm.) and equals $\frac{1}{3}$ of this distance. The rays gradually increase in length posteriorly to the last, which is half the same distance, and is confluent with the caudal rays.

The pectoral is equal to the length of the tentacle; its margin, which nearly reaches the dorsal, is wedge shaped. The anal is separated from the caudal and is equal to the length of the pectoral. The caudal is pointed and equals its distance from the gill opening.

Colour: Black, with the exception of the fins and circular patch at posterior of eye, which are white. The black colour extends a little way on to the bases of the vertical fins.*

Nearest to *M. Krechi* (*Brauer,* Zool. Anz. B. XXV, 7th April, 1902) agreeing with this species in having dorsal and anal confluent, but differing from it in height, being less than the length of body, the pectoral fin much shorter, eye partly hidden under skin, colour of fins, size of eye and shorter tentacle.

*Locality*: One specimen taken by shrimp trawl 36 miles off Cape Point (Cape Point Lighthouse bearing N.E. $\frac{3}{4}$ E.); depth, 600 fathoms; bottom, green mud. A specimen of *Melanocetus* 11·5 mm. in length (excluding caudal) had been procured by the *Pieter Faure* some time previously on the Natal coast (Cape Natal bearing N. by E., distant 24 miles) but was apparently an immature form. It differs in some points from that here described, but its determination may be held over till more mature specimens are found.

*Measurements* (in millimetres): Length of body, without caudal, 27, height 25, breadth 17, snout to gill opening 15, length of maxillary 17, tentacle 9, interorbital space 12, diameter of eye 2, length of pectoral 9, longest ray of dorsal and of anal 6, caudal 12.

With regard to the normal position of this fish when in the water, Brauer remarks: "Die bischer gegebenen zeichnungen von Melanocetus sind unsofern nicht richtig als diese Fische beim schwimmen den hinteren körpe-rtheil nicht horizontal halten sondern in die Höhe."

This I believe is founded on an observation of the living animal in a jar after being brought on board the *Valdivia.*

*Note.—The black colour becomes somewhat brown, and the white completely disappears in spirit.

We have had no opportunity of verifying the observation, as both specimens procured were dead when brought to the surface, but I have represented the animal (Plate No. XV.) in the usual horizontal position, as I have some hesitation in accepting the conclusion drawn from such an observation. A fish brought even from a moderate depth will continue for some time to assume this oblique position, as has been on several occasions observed in the tanks at the Marine Station, St. James'. After about a day they were observed to resume the normal horizontal position.

### Fam. **GADIDAE**

## LAEMONEMODES, n.g.

Body posterior to pectorals compressed, head somewhat depressed; scales small and deciduous. Two dorsal, one anal and a separate caudal fin. The anterior dorsal composed of 5 rays. The ventrals consist of two very long rays joined together for about $\frac{2}{3}$ of their length, and six very minute rays. Villiform teeth in jaws on vomer, but none on palatine, chin with a barbel. Branchiostegals 7.

Seems to be nearest to *Laemonema*, Günther differing from it chiefly in the ventrals, which in that genus are "reduced to a single long ray bifid at its end." This and the presence of additional rudimentary rays seem to necessitate the establishing of a new genus for this fish if we follow the general lines in which the genera of this section of the Gadidae have been laid down.

### *Laemonemodes compressicauda, n.sp.*

(Plate XVI.)

Br. 7. D. 5, 46. A. 46. V. 2+6. P. 20 circa.

Greatest height of body (11 mm.) is behind the commencement of anal and is contained in its length (without caudal) between 5 and 6 times. Head a little over 4 times. Eye large, contained 3 times in head, greater than interorbital space, which is equal to snout.

Maxillary extends to below middle of eye. Barbel $1\frac{2}{3}$ in diameter of eye. The distance of the first dorsal from the snout is somewhat more than length of head. The first of the 5 rays of the first dorsal is long, half the length of the ventral, and reaches to the base of the 5th ray of the second dorsal. The last ray of the first dorsal is short and is contained in the length of the 1st ray $4\frac{1}{2}$ times. The second

dorsal is long and ends a short distance (3 mm.) from the commencement of the caudal rays. The anal commences in the vertical from the first ray of the second dorsal and ends slightly in advance of its last ray, being at a distance (4 mm.) from the commencement of the caudal rather greater than the ending of the second dorsal. The ventral commencement of the caudal is somewhat anterior to that of the dorsal.

*Locality*: The single specimen was obtained by shrimp trawl at a depth of 300 to 400 fathoms, Bashee River beacon (on East Coast) bearing N. ½ E., distant 15 miles.

## Fam. **OPHIDIDAE**.

## SELACHOPHIDIUM, n.g.

Body compressed. Head somewhat depressed anteriorly. Body, snout (including anterior portion) and base of dorsal covered with small scales. Lateral line distinct and uninterrupted. Snout swollen, produced beyond jaws. Mouth large, inferior and horizontal; eyes large; nostrils large, far apart, the posterior in front of the eye, the anterior midway between the posterior and end of snout. Operculum with a spine. No barbels. Band of villiform teeth in jaws, on vomer and palatines. No enlarged teeth. Vertical fins confluent. Ventrals close together, each consisting of one undivided ray inserted in front of posterior edge of preoperculum. Gills 4 with long and short gill rakers. Branchiostegals 8. Pseudobranchiae present and small.

This genus appears to be most closely allied to *Catactyx*, but differs from it in following particulars.—Snout scaly on anterior part; eyes very large; lateral line distinct and uninterrupted; anterior nostril not at extremity of snout; no wide muciferous openings on suborbital, and only one on preoperculum; snout swollen; no series of larger teeth along sides of lower jaw; pseudobranchiae present.

### *Selachophidium guentheri, n.sp.*

(Plate XVII.)

Br. 8. D. 115. A. 88. C. 9. P. 26.

Greatest height of body $4\frac{1}{2}$ to 6 times its length. Length of head over $5\frac{1}{2}$. Longitudinal diameter of eye contained 3 times in length of head, vertical diameter $4\frac{1}{2}$ times, equals length of snout, slightly more than interorbital space and ½ length of ventral ray, which is a little shorter than pectoral.

Head conical, but depressed in front of the eyes, the snout being somewhat wedge shaped and blunt. Muciferous tissue well developed on snout, though there are no large pores. Glandular tissue on preoperculum with one large pore. Teeth on palatine and vomer villiform and as well developed as on jaws. The mandibular row fits in between that of upper jaw and vomer and palatine row when mouth is closed. Cavity of mouth and gill chambers black. The maxillary reaches to the posterior margin of the orbit. It is dilated behind. The dorsal fin commences a little behind the pectorals. It is of about equal height throughout, its longest ray being about $1\frac{1}{2}$ times the vertical diameter of the eye. The anal fin begins immediately behind the vent, which is situated well in front of the middle of the body. The ventrals are situated behind the end of the snout at a distance equal to the length of the head, excluding snout, and reach to about the second third of the pectoral fin.

There are thin scales on anterior part of dorsal, reaching to about half its height. None were perceived on the anal. The lateral line is slightly curved and runs parallel with the upper margin of the body. It is well marked on the anterior two thirds of the body, but can only be traced with difficulty to the caudal. There are about 12 series of scales between it and the base of the middle of the dorsal.

Colour : Body an uniform brown, dorsal and anal fins a little darker. The posterior portion of these fins and caudal black.

*Locality :* Several specimens procured along with other deep sea *Gadidæ* and *Macruridæ,* off the Cape Peninsula (Table Mountain bearing N. 79° E., distant 40 miles) by shrimp net at a depth of 250 fathoms, the bottom being green sand.

### Measurements of a Specimen.

(Most of the others were deeper in the body).

| | | |
|---|---|---|
| Length of body ... ... ... ... ... | 210 | mm. |
| Height „ „ ... ... ... ... ... | 34·5 | „ |
| „ „ head ... ... ... ... ... | 39 | „ |
| Longitudinal diameter of eye ... ... ... | 13 | „ |
| Vertical „ „ ... ... ... | 10 | „ |
| Interorbital space ... ... ... ... | 9·5 | „ |
| Snout ... ... ... ... ... ... | 10 | „ |
| Longest ray of dorsal ... ... ... ... | 15 | „ |
| Length of pectoral ... ... ... ... | 23 | „ |
| „ „ ventral ... ... ... ... | 20 | „ |
| Distance between snout and vent ... ... | 86 | „ |

## Fam. PLEURONECTIDAE.

### *Aphoristia variegata, n.sp.*

(Plate XVIII.)

D. 93. A. 88. V. 4. C. 14.

Height of body $4\frac{1}{2}$ times in length. Length of head $4\frac{3}{5}$ times. Snout 4 times in head. Eyes small, close together, upper slightly in advance of lower. Tubular nostril midway between lower eye and snout, close on margin of upper jaw, angle of mouth below centre of lower eye.

Scales small, rough, about 120 in a longitudinal series from upper angle of operculum to tail, 11 from eyes to angle of operculum, 43 in a transverse series. There are no scales between eyes and end of snout, but they are continued forward between the upper eye and the superior margin of the snout and on the mandible. No scales were found between the closely set eyes. Scales of both sides (1·3 mm.) oblong with relatively strong spines on margin and extending on to scales in a patch to less than a third of its length. Teeth villiform, equally developed in both jaws.

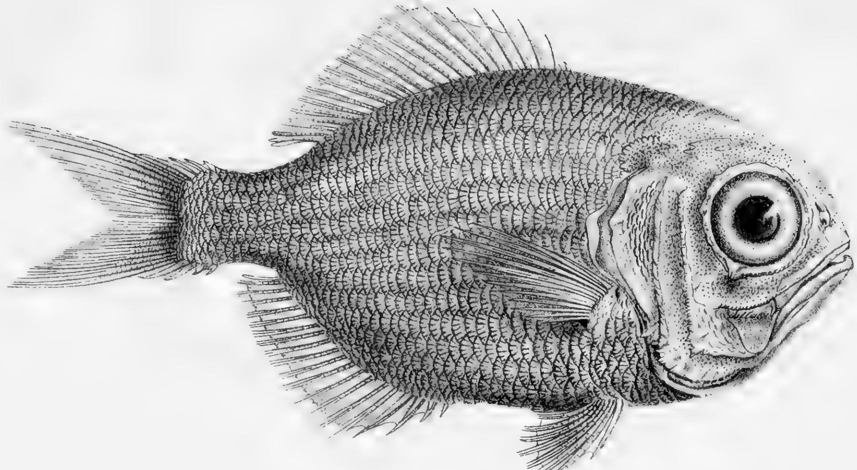
The dorsal fin begins over the posterior end of the upper eye, contains about 93 rays, and is confluent with caudal, longest ray (6 mm.) $2\frac{2}{3}$ in depth of body (16 mm.), first rays free. Anal begins 5 mm. from insertion of pectorals or 18 mm. from snout, confluent with caudal, longest ray equals that of dorsal. Ventral reaches to beginning of anal, rays 4, situated on isthmus where gill membrane crosses it. Vent immediately in front of anal. Total length, including caudal, 78 mm., 69 without caudal.

Colour: 8 or 10 indistinct cross bands of very irregular arrangement may be distinguished on body.

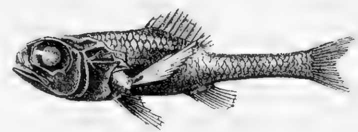
*Locality:* Only one specimen procured, off coast of East London (Buffalo River bearing North, distant 15 miles) by shrimp trawl at a depth of 310 fathoms.

---

[PUBLISHED 8TH JULY, 1903.]



1.

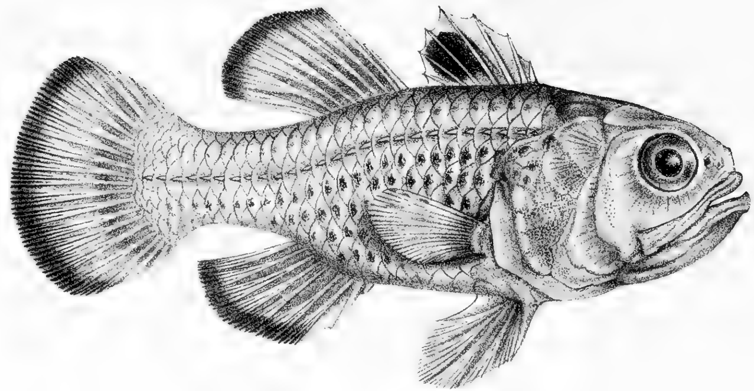


2.

F. A. Newdigate del.

Mintern Bros. lith.

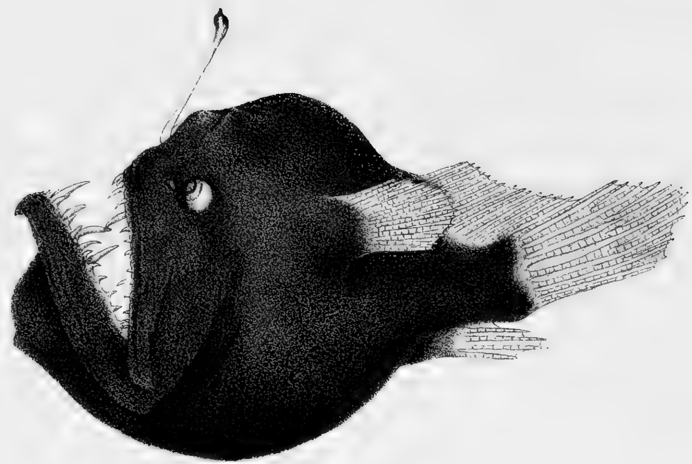
1. TRACHICHTHODES SPINOSUS. n. g. & sp. 2. PLECTROMUS MACROPHTHALMUS. n. sp.



F. A. Newdigate del.

APOGON QUEKETTI. n. sp.

Mintern Bros lith.



F.A. Newdigate del.

Mintern Bros. lith.

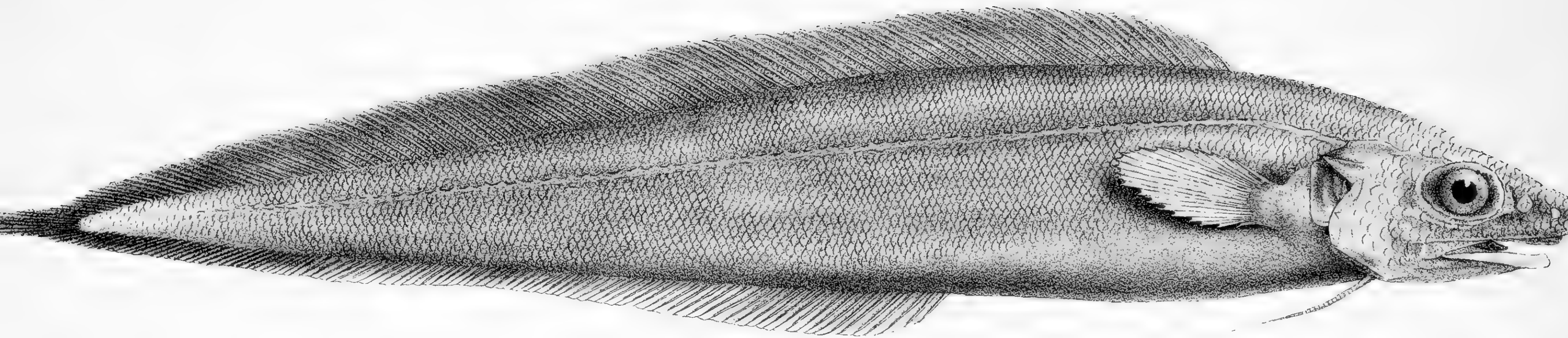
MELANOCETUS ROTUNDATUS. n. sp.

TL74 1NX JB

F. A. Newdigate del.

Mintern Bros. lith.

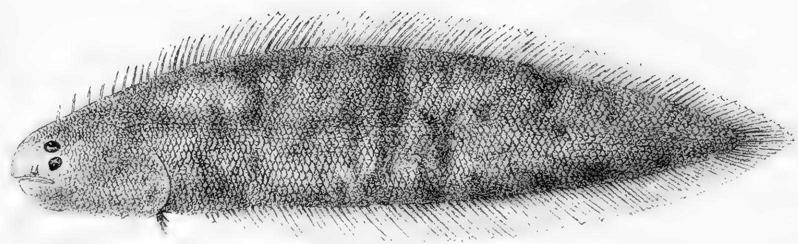
LAEMONEMODES COMPRESSICAUDA. n. g. & sp.



L. A. Brimble del.

Mintern Bros. lith.

SELACHOPHIDIUM GUENTHERI. n. g. & sp.



F. A. Newdigate del.

Mintern Bros. lith.

APHORISTIA VARIEGATA. n. sp.

# MOLLUSCA OF SOUTH AFRICA

BY

G. B. SOWERBY, F.L.S.

Since writing my short paper, published in "Marine Investigations of South Africa," 1902, a quantity of additional material has come to hand, which I have carefully examined. Most of the Mollusca I have identified, a large proportion needing no special comment. The 25 species herein described I believe to be new to science; and following these descriptions I have appended notes on a few species little known, of special interest, or hitherto inadequately described, giving figures in the accompanying plates of such as have not hitherto been figured. In recording the results of my investigations, I have gratefully to acknowledge the valuable assistance of Messrs. S. Pace, E. A. Smith, and E. R. Sykes.

Mr. Pace has examined the animal and radula of *Sipho pyrrhostoma* of Watson, finding that it does not belong to the *Fusidæ*, but to the *Volutidæ*, so that I have placed it in my genus *Neptuneopsis*, of which *N. Gilchristi* is the type.

The soft parts of some of the other species are still reserved for examination, and will be reported on later.

## New Species.

PLEUROTOMA (SURCULA) LOBATA (Plate IV., fig. 9). Shell elongately fusiform, posterior long, anterior short, yellow[ish] white. Spire elongately turreted, slightly convex at the sides whorls 10; slightly angular, ornamented at the angle by a row of small rounded prominent tubercles, numbering 13 on the penultimate whorl; a sharpish keel borders the whorls at the upper part, between which and the angle a faint thread-like ridge is discernible. Last whorl shorter than the spire, with a double keel below the periphery which terminates in a remarkable deflexed tube-like projection, forming a lobe to the aperture; base conspicuously lirate; rostrum short, slightly recurved. Aperture moderate; columella rather straight above, slightly tortuous at the base, covered with a thin, smooth laminar callus; outer lip thin, with a broad shallow sinus at the posterior angle, in addi-

tion to the before-mentioned lobe which forms a curious anterior sinus. Canal short, rather wide. Length 31; width 11 millim.

Hab.:—Cape Natal bearing N. by E.; distant 24 miles; depth, 440 fathoms. Bottom, mud. Also (dead shells) Buffalo River, bearing North; distant, 15 miles; depth, 310 fathoms.

This remarkable shell is characterised by the double keel of the anterior angle becoming merged towards the finish of the last whorl, so as to form an almost tube-like process projecting from the aperture. This is present in all the adult specimens I have seen, but it varies in length and position, in some cases lying further back, and terminating before quite reaching the edge of the aperture. The shell bears some resemblance to *Pleurotoma congener*, Smith (Annals and Magazine of Natural History, 1894, Vol. IV., page 160, plate III., figs. 4 and 5), some specimens of which show indications of the above-mentioned character, but irregularly and in a less marked degree, so that it is not mentioned in Smith's description. The two species are however no doubt specifically distinct.

Pleurotoma (Drillia) fossata (Plate III., fig. 5). Shell fusiform, acuminated at both ends, pale fulvous, obscurely spotted with brown, here and there tinged with light purple, and coloured anteriorly with a purplish band. Spire acute, gradately turreted; whorls 8, the first two smooth, rounded, forming a papillary apex, the third angular and ribbed below the angle, the rest deeply concave at the top, the concavity being bordered by a sharp erect keel, below which the whorls are slightly convex, with short very oblique plicæ, and about 5 spiral liræ which are sharply angular at the top and slopingly compressed on the under side. Last whorl about equal in length to the spire, slightly convex above, and tapering to the base; the oblique plicæ against the keel become almost obsolete on the latter half of the whorl, while the spiral liræ numbering about 22 are quite as deep and broad as those on the upper whorls. Aperture oblong, moderately wide, without any definite anterior canal; outer lip thin, with rather a broad sinus at the juncture of the whorl.

Length 22; width 7 millim.

Hab.:—Cape Vidal (Natal) bearing N.N.E., $\frac{1}{4}$ N.; distant $9\frac{1}{2}$ miles; depth, 80 to 100 fathoms. Bottom, rock.

A shell of a very distinct character, quite unlike any other known species. The sharp erect keel at the top of the whorls, the broad channel between this and the suture, and the numerous curiously sloping spiral liræ throughout, are its chief characteristics.

Pleurotoma (Drillia) scitecostata (Plate IV., fig. 10). Shell fusiform, acuminated at both ends, light brown colour with-

out markings. Spire acutely turreted; whorls 8, apical ones smooth rounded oblique, the rest deeply and smoothly concave at the top, then slightly convex, furnished with numerous oblique rounded smooth close-set ribs, the ribs terminating in a well-defined angle at the top. Last whorl about equal in length to the spire, slightly convex above and tapering below; spirally lirate towards the base, scarcely rostrate. Aperture oblong, interior smooth, brown; columella rather straight; lip thin, arched, with a moderate posterior sinus situated close to the suture.

Length 20; width 7 millim.

Hab.:—Glendower Beacon (near Port Alfred) bearing N. $\frac{1}{4}$ W.; distant 21 miles; depth, 100 fathoms. Bottom, sand and stones.

An elegantly formed and sculptured shell, somewhat resembling *P. harpularia*, Desmoulins, but more fusiform, and without the prominent sutural ridge characteristic of that species.

PLEUROTOMA (CLAVATULA) TURRIPLANA (Plate III., fig. 6). Shell elongately turreted, light brown, with a whitish band in the middle of the whorls. Spire long, acutely turreted; whorls 12; the first two smooth, rounded, forming a somewhat prominent white papillary apex; the rest slopingly convex, slightly impressed below the suture, spirally faintly grooved, obliquely obscurely plicated. Last whorl about 2.5ths of the entire length of the shell, convex above, attenuated towards the base, scarcely rostrate, nearly smooth, spiral grooves (only visible with a lens) irregular and broken up, oblique wrinkles almost obsolete. Aperture rather long, moderately wide; interior tinged with pale pink; columella white, rather straight, very slightly flexuose; outer lip sharp, with a broad posterior sinus, situated between the angle and the suture.

Length 42; width 11 millim.

Hab.:—Cape St. Blaize bearing N. by E. $\frac{1}{4}$ E.; distant 65 miles; depth, 85-90 fathoms.

Only one adult and one young specimen. An unusually smooth shell for one of this genus, with a long spire. The specimen having no operculum, I am unable to say with certainty that it belongs to the sub-genus *Clavatula*, but judging from the protocouch and the general appearance of the shell there is scarcely room to doubt it.

PLEUROTOMA (CLAVUS) LIGNARIA (Plate III., fig. 4). Shell irregularly fusiform, pallid, without colour markings, obtusely angular, posterior acuminated, anterior rather obliquely subconical. Spire rather long, acute; whorls $10\frac{1}{2}$, the first two smooth, rounded, forming a papillary apex; the next two slightly convex,, nearly smooth, the rest with the upper half slightly con-

cave, with a rounded slightly tubercular ridge just below the suture; the lower rather convex, furnished with a row of oblong nodules, or short stout costæ (9 on the penultimate whorl); very finely spirally striated throughout. Last whorl about equal in length to the spire, obtusely angled; left side obliquely sloping, right rather convex; no rostrum; the nodules at the angles are produced downwards so as to form slightly oblique stout rounded ribs. Aperture rather short; columella nearly straight, covered by a thin callus which is somewhat thickened above; outer lip slightly arcuate, anterior canal very short, posterior sinus deep and moderately wide, situated at the angle of the whorl.

Length 22; width at angle 9 millim.

Hab.:—Lion's Head bearing N. 67° E.; distant 25 miles; depth, 136 fathoms.

This shell presents the slight obliquity of form prevailing in the sub-genus or section *Clavus*. It is singularly destitute of colour markings, and does not bear a striking resemblance to any known species, but perhaps its nearest ally is *P. Edithæ*, Sowerby.

PLEUROTOMA (GENOTIA) BELÆFORMIS (Plate IV., fig 8). Shell broadly fusiform, acuminately conical at both ends, whitish. Whorls 6½, slightly convex, obtusely angled above, with a punctured groove a little below the suture; obliquely irregularly wrinkled, spirally striated. Last whorl about three-fifths of the entire length of the shell, rather inflated above, tapering below, without rostrum; spiral striæ numerous and close, oblique wrinkles almost obsolete. Aperture rather wide in the middle, interior white, columella slightly twisted, outer lip sharp, with a broad posterior sinus.

Length 22; width 9 millim.

Hab.:—Vasco de Gama Pk. bearing N. 71° E.; distant 18½ miles; depth, 230 fathoms.

A shell of simple character, having somewhat the aspect of a northern form of *Bela*.

MANGILIA (EUCYTHARA) AFRICANA (Plate V., fig. 9). Shell fusiform, acuminated at both ends, obtusely angled in the middle, somewhat obscurely banded with light and dark brown, with narrow whitish interstices, dark purplish brown between the angle and the suture. Spire rather long, acute; whorls 7, angularly convex, finely spirally striated throughout, longitudinally regularly ribbed, ribs narrow, rather distant (12 on the penultimate whorl). Last whorl longer than the spire, angular above, then slightly convex, attenuated towards the base, terminating in a short narrow slightly recurved rostrum. Aperture long, rather wide in the middle, and narrower at each end; interior closely plicated, dark

brown with a whitish median band; columella rather straight recurved at the base, furnished with numerous small plicæ; outer lip sharp at the edge, externally thickened by a stout rounded varix; posterior sinus shallow, but rather wide.

Length 20; width 7 millim.

Hab.:—Umhloti River Mouth bearing N.W. by W. $\frac{3}{4}$ W.; distant $2\frac{3}{4}$ miles; depth, 25 fathoms.

This shell somewhat resembles *C. funiculata*, Reeve, but it is less sharply angled, the sides being more convex.

CONUS EUCORONATUS (Plate III., fig. 9). Shell rather solid, angular, whitish, profusely spotted with light brown, banded with three more or less interrupted zones of dark brown. Spire conical, rather elevated, coronated; whorls 9, angular; above the angle concave, rugosely plicated, and furnished with a single narrow ridge; at the angle ornamented with numerous white rounded bead-like nodules, numbering 26 on the last, and 23 on the penultimate whorl. Last whorl scarcely convex, regularly tapering from the angle to the base; spirally deeply grooved, and longitudinally closely plicated throughout. Aperture of average width, with a rather deep posterior sinus.

Length 45; width 34 millim.

Operculum very small (5 x $1\frac{1}{4}$ millim), regularly oblong, laminated, nucleus at the anterior extremity.

Hab.:—Cape St. Blaize bearing N. 85° W.; distant $4\frac{1}{2}$ miles; depth, 27 fathoms. Bottom, sand.

A handsome shell, belonging to the *Asprella* group, but quite unlike any hitherto known species. A second specimen (obtained on Natal coast, Cape Natal bearing W. $\frac{3}{4}$ N.; distant $12\frac{1}{2}$ miles; in 85 fathoms) is paler in colour, and of even rougher sculpture.

CONUS GILCHRISTI (Plate III., fig 8). Shell moderately solid, rather broadly sub-cylindrical, white, coloured with irregular brown streaks and blotches of various forms, interspersed with small spots, etc.; covered with a thin transparent periostracum. Spire very little raised, acute at the apex; whorls 9; slightly concave, with growth lines but no spiral sculpture. Last whorl rounded at the angle, sides nearly straight, obscurely lirate at the base. Aperture moderate, lip simple, with a rather deep posterior sinus.

Length 21; width 27 millim.

Hab.:—Umhlangakulu River Mouth (Natal) bearing N.W. by N.; distant $7\frac{1}{2}$ miles; depth, 50 fathoms. Bottom, sand and shells. (A single specimen in perfect condition.)

In general appearance this shell is something like *C. Characteristicus*, Chemnitz, but its form is narrow and more cylindrical, and the whorls of the spire are not grooved as in that species.

CONUS PATENS (Plate III., fig. 7). Shell thin, light, elongately pyriform, white, with a few very faint fulvous markings a little above the middle of the body whorl; covered by a rough and scabrous but light coloured periostracum. Spire moderately elevated, acute, graduated; whorls 8, concave, keeled at the angle, without spiral sculpture. Last whorl slightly convex, tapering towards the base; with slightly waved growth lines, and very faint spiral liræ visible only in parts and under the lens; the liræ at the base are scarcely more apparent than those on the other parts of the shell. Aperture rather wide, the posterior end a little narrower; outer lip thin and simple, with a deep, rather broad posterior sinus.

Length 68; width 35 millim.

Operculum remarkably small for the size of the shell (6 by $2\frac{1}{2}$ millim.) laminar, slightly scabrous, not regularly oblong, but expanded on the right anterior side, with the nucleus inclining to the left.

Hab.:—Vasco de Gama Pk. bearing N. 10° E.; distant 13 miles; depth, 85 fathoms. Bottom, green sand. Only one full-sized specimen obtained; but several much smaller ones were taken at different stations.

This shell bears some resemblance to *C. fulvocinctus*, Crosse, but it is of a lighter substance, and destitute of the basal liræ which are somewhat prominent in that species.

CYPRÆA FULTONI (Plate IV., fig. 7). Shell depressly pyriform, with a slight angularity at the sides near the posterior end, produced by a tubercle or swelling on each side; extremities slightly produced; pale fulvous variously marked with brown streaks and spots, suffused with dark brown at each end, and ornamented with numerous rather large dark brown spots at the sides partly extending over the base; beaks at the posterior extremity rather wide apart, surmounted by a thick brown callus, completely hiding the apical whorls; beaks at the anterior extremity closer together and slightly incurved; back rather depressly rounded, obliquely sloping in front; base slightly convex. Aperture of moderate width, with a prominent plait at the base of the columella; teeth on the left side of the aperture 11, the anterior ones being thick and short, the rest narrower and irregularly placed; on the right side 18, more regular, extending partly across the base, and leaving brown stripes where they become obsolete.

Length 60; width 39; height 29 millim.

Hab.:—South Africa.

Only a single dead specimen of this striking new species has yet been found. The package in which it came was broken in transit, and the number referring to the locality lost.

The dorsal aspect of the shell is somewhat similar to that of *C. leucostoma*, but it is larger, and the base is entirely different.

NASSA DESMOULIOIDES (Plate IV., fig. 1). Shell sub-ovate, anterior rounded, posterior conical, whitish, stained and irregularly streaked with brown. Spire acutely conical; whorls 8, the first 2 smooth polished and regular, the rest convex, rounded, spirally closely lirate, and longitudinally ribbed, the ribs being rounded, and about the same width as the interstices, numbering 10 on the penultimate whorl; the spiral liræ (7 in number) are also rounded and close, becoming here and there slightly nodulous on crossing the ribs; suture concavely impressed. Last whorl roundly inflated, the longitudinal ribs becoming irregular and obsolete, while the spirals (numbering about 16) are rather more distinctly nodulous; the very short rostrum at the base is somewhat tortuous, and distinctly lirate; it is defined by a distinctly channeled groove separating it from the rest of the whorl. Aperture sub-ovate; columella covered by a thin callus, slightly spread upon the middle of the whorl and forming an erect wall at the side of the umbilical region, with a rather prominent obliquely curved plica at the base; outer lip crenulated at the margin, lirate within; canal very short, recurved.

Length 21; width 13 millim.

Operculum thin, corneous, oblong, triangular, serrated with 5 projecting cusps on the right and two on the left side.

Hab.:—Umhloti River Mouth (Natal) bearing N.W. ½ W.; distant 15½ miles; depth, 100 fathoms. Bottom, sand and shells.

A pretty shell, having somewhat the form and appearance of a *Desmoulea*.

NASSA ANALOGICA (Plate IV., fig. 3). Shell oblong-ovate, yellowish white, banded with light brown. Spire acutely conical, rather long; whorls 7, slightly convex, spirally regularly grooved, grooves 6 in the penultimate whorl, intervals flat. Last whorl about ⅔ the entire length of the shell, slightly inflated. Aperture ovate, slightly expanded towards the front; interior tinged with pale violet, smooth; outer lip simple, very little thickened; columella arched, with a sharp twist at the base, covered with a thin, glossy, transparent callus.

Length 19; width 10 millim.

Operculum thin, horny, irregularly trigonal, with the nucleus at the anterior extremity, inclining towards the left.

Hab.:—Cape Infanta bearing N. ¾ E.; distant 6½ miles; depth, 40 fathoms. Bottom, mud.

This species is nearly allied to *N. trifasciata*, A. Adams (Plate IV., fig. 2), but the difference in form, as shown by the figures,

pp 221' 224 fr



appears to be constant; the latter is more fusiform, and has a narrower aperture; its spire is longer in proportion to the body whorl, and generally more or less plicated; while all the numerous specimens of *N. analogica* I have before me are smooth, excepting for the spiral grooves. These differences may appear to be merely varietal, but the comparison of a large number of specimens shows that they are singularly persistent, and the two forms when separated show very little variation.

CANCELLARIA PRODUCTA (Plate IV., fig. 5). Shell elongately acuminated, very pale buff colour. Spire narrowly pyramidal; whorls $7\frac{1}{2}$, the first $2\frac{1}{2}$ rounded, smooth, shining, regular, the rest convex, latticed by numerous spiral liræ, and longitudinal ribs; the spirals (6 or 7 on the penultimate whorl) form little nodules in crossing the ribs, some of which are spinously raised in proximity to the suture; suture rather deeply channelled. Last whorl a little longer than the spire, closely cancellated throughout. Aperture sub-ovate, rather small; columella nearly straight, with 3 oblique nearly equal plicæ; outer lips sharp at the edge, and slightly thickened by the external rib.

Length 17; width 7 millim.

Hab.:—Off Umhloti River Mouth (Natal); depth, 40 fathoms (two specimens only).

This shell resembles in form some of the species of the genus Phos.

EPIDROMUS CREBRILIRATUS (Plate IV., fig. 4). Shell narrowly oblong, fulvous, faintly banded and variegated with brown, pearly white at the apex. Spire elongately acuminated, slightly convex at the sides; whorls $5\frac{1}{2}$, the first $1\frac{1}{2}$ smooth and shining, the rest rather convex, irregularly plicate and varicose; spirally finely grooved; suture scarcely impressed. Last whorl oblong, rather straight sided, with a very short rostrum at the base. Aperture rather wide in the middle, and narrow at each end; columella covered with a thin white callus standing erect over the umbilical region, slightly and irregularly pustulate; canal short, narrow, slightly recurved.

Length 13; width 5 millim.

Hab.:—Glendower Beacon (near Port Alfred) bearing N. $\frac{1}{2}$ W.; distant 21 miles; depth, 100 fathoms. Bottom, sand and stone. (Two specimens only.)

Somewhat resembling a small form of *E. lanceolatus*, Menke, but quite different in sculpture.

SCALA TENEBROSA (Plate IV., fig. 6). Shell elongately turreted, dark brown, with ribs of a somewhat lighter colour. Spire

I am inclined to ignore these sub-divisions as being insufficiently defined. The length of the slit not only varies considerably in different examples of the same species, but in some it is absent; the striation is also a very unreliable character. In *D. Africanum* some specimens show only the V shaped notch, others a short fissure below, while others again have quite a long fissure. I have selected an average one for the type. Some of the young specimens are striated towards the apex.

DENTALIUM EXASPERATUM (Plate V., fig. 12). Shell moderately solid, very little curved, rather wide at the base, and gradually tapering to the apex, pale yellow, longitudinally ribbed; principal ribs about 13, scabrous through the crossing of fine transverse laminæ, an intermediate much smaller rib between each, the interstices being cancellated by minute longitudinal ridges and fine transverse laminæ. Apical fissure on the convex side, about one-tenth the length of the shell.

Length 32; width at the aperture 5, and at the apex 1 millim.

Hab.:—Umvoti River Mouth (Natal) bearing N. by W. ½ W.; distant 4½ miles; depth, 27 fathoms. Bottom, sand and shells.

An example of the "*Fissidentalium*" group of a peculiarly scabrous character.

CHITON (HANLEYA) SYKESI (Plate V., fig. 13). Shell elongated, whitish, with the back much raised, and the sides sloping, scarcely convex; dorsal ridge rounded; throughout very finely granulose. Anterior valve crescent shaped, marked with concentric growth lines, but no radiating sculpture; insertion plate scarcely defined, unslit. Posterior valve with apex nearly central, raised, rather acute. Intermediate valves without insertion plates; obtusely beaked; lateral areas well defined, flattened, roughly marked with irregular concentric ridges and growth lines; central areas smooth, excepting for the fine granular sculpture which covers every part of the exterior of all the valves. Girdle very minutely spiculose.

Length about 22, width of central valve 7½ millim.

Cape Point Lighthouse (False Bay) bearing E.; distant 26½ miles; depth, 210 fathoms. Also Vasco de Gama Pk. bearing S. 75° E.; distant 13½ miles; depth, 166 fathoms.

A careful examination of the valves and girdle of this species shows that it belongs to Gray's genus, *Hanleya*, which Pilsbry places in the Family *Lepidopleuridæ*. Malacologists are at liberty to use their own discretion as to the adoption of the numerous family and generic names proposed for the *Polyplacophcra*, but for my part I very much question their utility, and prefer to call *Hanleya* a sub-genus of Chiton.

## Notes on Species little known, inadequately described or hitherto unfigured.

NEPTUNEOPSIS PYRRHOSTOMA, Watson (Plate III., fig. 1). *Fusus* (*Sipho*) *pyrrhostoma*, Watson, Linn. Soc. Journal, Vol. xvi., p. 374.

The shell of this remarkable mollusk resembles in some respects that of *Sipho cretaceus*, Reeve. It is, however, far removed from that family, and through the kindness of Mr. S. Pace, who has examined the soft parts, I am able to state conclusively that it belongs to the *Volutidæ*. Mr. Pace says: "The sum of the characters of this interesting form leaves no doubt but what it should be referred to the volutoid series in the immediate neighbourhood of *Neptuneopsis*." At present I see no reason why it should not be included in that genus. Although a much smaller object there is nothing, conchologically speaking, to separate it generically from my *Neptuneopsis Gilchristi*; the structure of the head is practically the same; and, as in that species, the eyes are reddish, not black as are those of the majority of the Prosobranchs. The siphon has the lateral expansion met with in *Neptuneopsis*. The introvert apparatus is strongly developed, and in the retracted state it forms a large, almost globular mass. Two pairs of salivary glands are represented, and are of the characteristic Volutoid type. Leiblein's gland is enormously developed; it is of greater calibre than the œsophagus and occupies the major portion of the body-cavity, but its walls appear comparatively thin. The nervous system is typically Volutoid, and the supra-œsophageal ganglion is situated in close proximity to the nerve-ring.

The radula is uniserial; and the teeth in shape are rather intermediate between those of *N. Gilchristi* and *Cymbiola ancilla*.

VOLUTA (LYRIA) QUEKETTI, Smith. (Proc. Malac. Soc. Vol. IV., p. 234. Cape Natal bearing N. ½ W.; distant 4½ miles; depth, 27 fathoms. Also, O'Neil Pk. (Natal) bearing N.W. ¼ W.; distant 9½ miles; depth, 90 fathoms; and Umhloti River Mouth (Natal) bearing N.N.W.; distant ½ mile; depth, 27 fathoms. Very rare.

MARGINELLA DIADOCHUS, Adams and Reeve, Voy. Samarang, 28, plate 7, fig. 4, 1860. Cape St. Blaize bearing N. by E. ¼ E., distant 65 miles; depth, 85-90 fathoms, and 90-100 fathoms. The original specimens of this rare species were procured in the voyage of the "Samarang" in the straits of Sunda.

MARGINELLA FUSIFORMIS, Hinds, Proc. Zool. Soc., 1844. Nanquas Pk., East of Bird Is. (S.E. Coast), 49 fathoms. This species is reported by Hinds from the Straits of Malacca, and by Deshayes from the Island of Bourbon.

MITRA CYLINDRACEA, Reeve, Conch. Icon. (Mitra), sp. 97. A single specimen found 4½ miles N. 85° W. off Cape St. Blaize, in 27 fathoms. *Mitra punctostriata*, A. Adams, appears to me to be the same species. I believe it to be distinct from *M. variabilis*, Reeve.

MITRA DÆDALA, Reeve. Conch. Icon. (Mitra), species 281, Scottsburgh Lighthouse (Natal) bearing N.W. by N.; distant 8 miles; depth, 92 fathoms. Dead shells.

MUREX FALLAX, Smith. Journal of Conchology, 1901, Vol. X., p. 113, pl. 1, fig. 9.

A good specimen of this fine species taken 8 miles South of Port Shepstone (Natal), in 36 fathoms.

MUREX AXICORNIS, Lamarck. Var?

Shell of a light buff colour with brown blotches; broader in form than the typical *M. axicornis*, with the frondose spines less curved. When more specimens come to hand, this may prove a distinct species. One adult specimen.—Umhloti River Mouth (Natal) bearing N. by W. ½ W.; distant 8½ miles; depth, 110 fathoms.

TROPHON CARDUUS, Broderip (Murex), Proc. Zool. Soc., 1832. A good specimen of this species was taken at Natal (Port Shepstone bearing N.W. by W.; distant, 11 miles) depth, 250 fathoms. This species was dredged by Mr. Cuming at Pasemayo, coast of Peru, at 25 fathoms; so that although very rarely met with, it is evidently very widely distributed.

FASCIOLARIA RUTILA, Watson (Plate III., fig. 2, young shell and radula), Linn. Soc. Journal, Vol. xiv., p. 335.

A fine perfect specimen of this interesting species was taken off Umhloti River Mouth, 40 fathoms. The young shell figured was taken with Lion's Head bearing N. 63° E.; distant 34 miles; depth, 154 fathoms. It has a very large protoconch, whereas that of the full-sized specimen is quite small. The radula is that of a true *Fasciolaria*, and a cursory examination of the animal shows that it is rightly placed in that genus, although the shell has much the look of a Sipho.

LATIRUS ABNORMIS, Sowerby, Journal of Conchology, Vol. vii., p. 6, 1894.—*L. imbricatus*, Sow., Marine Investigations of

South Africa, Page 96, Plate 2, fig. 1. The comparison of a number of specimens recently acquired by the British Museum has convinced me that the two supposed species are not separable. There is considerable discrepancy between my description of the species in the Journal of Conchology and the figure given in Marine Shells of South Africa," Plate VI., fig. 7 (Appendix, 1897), which may be accounted for by the fact that the shell described having been returned to its owner, I unfortunately figured a different specimen to represent the species; and neither of the two shells is now accessible to me.

FUSOS RUBROLINEATUS, Sowerby, Proc. Zool. Soc., 1870, page 252. Good but small specimens of this pretty species found 30 miles S. of Cape St. Blaize, in 53 fathoms.

LATIAXIS TORTILIS, A. Adams, Proc. Zool. Soc., 1863, p. 431. Vasco de Gama Pk. bearing S. 75° E.; distant 13½ miles; depth, 166 fathoms. A single fine specimen. I cannot agree with Dr. Gray in referring this species to *L. idolea*, Jonas.

NASSA TRIFASCIATA, A. Adams (Plate IV. fig. 2).—*Nassa trifasciata*, A. Adams, Proc. Zool. Soc., 1851 (non Gmelin). I have compared the specimens taken off the South African Coast (Nanquas Pk. bearing N.E. ¾ N.; distant, 11½ miles) depth, 58 fathoms; with those in the British Museum from Vigo Bay (including the type) and find them identical. The species is quite distinct from the Mediterranean, *N. corniculum*, Olivi, and *N. semistriata*, Brocchi. See remarks on *N. analogica*, Sow. n. sp.

PSEUDOLIVA ANCILLA, Hanley, Proc. Zool. Soc., 1859, p. 429. Sowerby, Marine Shells of South Africa, Plate 1, fig. 14. A single specimen in perfect condition taken at Lat. 34° 45′ 20″ S., Long. 25° 44′ 20″ E., 40 fathoms. (Bottom, mud.) The animal is under examination.

ANCILLA CONTUSA, Reeve (Plate III., fig 3). Red-topped Hill, W. of Untwalumi River (Natal), bearing N. by W.; distant 2 miles; depth, 25 fathoms. Also Illovo River Mouth (Natal), bearing N.W. by N. ¾ N.; distant 5 miles; depth, 27-30 fathoms. The specimens do not much resemble Reeves' type (Conch. icon., Ancillaria, sp. 31), which I find to be abnormal. I therefore figure what I believe to be the normal form of the species.

ANCILLA BULLOIDES, Reeve. Conch. Icon. Ancillaria, species 37. Lion's Head bearing S. 72° E.; distant 47 miles; depth, 190 fathoms. The habitat of this curiously Bullia-like species was not known to Reeve.

ANCILLA ANGUSTATA, Sowerby. Thes. Conch. Vol. 1, p. 399, plate 77, figs. 169, 170. Cape Point Lighthouse bearing N.W. by W. ¾ W.; distant 2½ miles; depth, 42 fathoms.

TRITONIDEA NATALENSIS, Smith. Journal of Conchology, Vol. X., p. iii., pl. 1, fig. 23. *Tritonidea subrubiginosa*, Sow. (non Smith), Journ. of Conch, Vol. VII., p. 368.

Mr. Smith considers the shell I took for his *T. subrubiginosa* to be a different species. I adopt this view with some reserve, as some specimens recently received from Japan are distinguished by very slight differences from the S. African form.

ONISCIA MACANDREWI, Sowerby. Proc. Zool. Soc., 1888, page 567, Plate XXVII., figs. 1, 2.

Specimens of this rare and beautiful species taken off Natal Coast: O'Neil Pk.: bearing N.W. ¼ W.; distant 9½ miles; depth, 90 fathoms; Port Shepstone bearing N.W. by W.; distant 11 miles; depth, 250 fathoms; and Cape St. Blaize bearing N. 85° W.; distant 4½ miles; depth, 27 fathoms. The original specimens came from Japan.

NATICA SAGRAIANA, Orbigny. Var.

A light coloured variety, taken at Saldanha Bay, Vondeling Island bearing N. ¼ W.; distant 3½ miles; depth, 28 fathoms. The species is evidently very widely distributed. Tryon quotes West Indies, Madeira, West Africa, and Mediterranean as its habitats.

VANIKORO CANCELLATA, Lamarck.

A single specimen. Rame Head (Natal) bearing W. by N. ½ N.; distant 3 miles; depth, 43 fathoms.

PLEUROTOMA (CLAVATULA) GRAVIS, Hinds. Moll. Voy. Sulphur, page 16, pl. V., fig. 6.

Cape Infanta bearing N .by E. ½ E.; distant 18 miles; depth, 47 fathoms; Pinnacle Pt. (West of Cape St. Blaize) bearing E. by S.; distant 3 miles; depth, 17 fathoms, etc.

Tryon (Man. of Conch., Vol. VI., p. 229) amalgamates this and several other totally distinct forms under the head of *Clavatula muricata*. He does not even call them varieties, but simply synonyms! This is quite too fanciful a *melange*; and it is difficult to conceive by what process or aberration of vision it has been reached. The forms are so manifestly distinct that it is quite unnecessary to go into detail. There are scarcely any two species of the same genus more utterly distinct than *C. gravis*, and *C. muricata*, as shown by Tryon's own figures.

Cypræa Barclayi, Reeve. Proc. Zool. Soc., 1857, p. 208, pl. 38, fig. 4.

Cape St. Blaize bearing N.; distant 30 miles; depth, 55 fathoms. (A single dead shell.)

The type of this species, hitherto believed unique in Miss Saul's collection (now in the Zoological Museum of Cambridge University) was dredged by Sir David Barclay off the Island of Diego Garcia. It is interesting to find a specimen, although a dead one, in South African waters.

Cypræa similis, Gray. Var.?

Nanquas Pk. bearing N. ¾ W.; distant 21½ miles; depth, 63 fathoms. (One specimen.)

A peculiarly globose form, which may possibly represent a distinct species, but pending the arrival of other specimens, it is better to consider it a simple variety.

Pedicularia sicula, Swainson.

94 miles off Cape St. Blaize, 116 fathoms.

A single specimen, identical in character with the Mediterranean shells, but rather larger than any I have seen.

Turritella declivis, Adams and Reeve. Voy. Samarang, page 48, 1848.

Glendower Beacon (near Port Alfred) bearing N. ½ W.; distant 16½ miles; depth, 66 fathoms; Great Fish Pt. Lighthouse bearing N.W.; distant 9 miles; depth, 51 fathoms, etc.

Cancellaria imbricata, Watson. Linn. Soc. Journal of Zoology, Vol. XVI., p. 325. Moll. Challenger Expedition.

A fine adult specimen, with peristome somewhat expanded. The shell is very like a large *Admete*, but the columella plaits are much more distinct.

Astralium Andersoni, Smith (Plate V., fig. 5).

*Astralium* (*Bolma*) *Andersoni*, Smith. Journal of Conchology, Vol. X., page 248, 1902.

Lat. 32° 45′ 45″ S., Long. 28° 26′ 15″ E., depth, 36 fathoms.

Two specimens, the largest 65 millimetres in width, and nearly 60 in height; the smallest 33 x 30. The large specimen (figured) has a prominent keel at the basal angle of the body whorl, which is armed with about 10 projecting, somewhat flattened scales. The operculum is nearly white, smooth, much thickened at the posterior end, and slightly concave in the middle. This can hardly belong to the "*Bolma*" section, of which *Tarbo rugosus*, Linn., is the type, as the character of its operculum is very different, but it probably belongs to the same

section as *T. modestus*, Reeve, which I think has been erroneously placed with *Bolma*. Mr. Smith's type is a young shell, measuring only 31 x 27 millimetres.

MINOLIA LÆVISSIMA, Martens. (Plate V., fig. 2).

*Trochus lævissimus*, Marts. Sitzungsh. Gesellsch. Naturf. Freunde, 1881, p. 65. *Nachœroplax lævissima*, Marts in Thiele, continuation Troschel's Gebiss and Schnecken.

Cape Natal bearing N. ½ W.; distant 4½ miles; depth, 55 fathoms.

Specimens rather larger than Von Martens' type, and differing therefrom in having well-defined colour flames on the base.

PUNCTURELLA NOACHINA, Linn.

Lion's Head bearing S. 82° E.; distant 27 miles; depth, 125 fathoms.

One shell only, in perfect condition.

DENTALIUM POLITUM, Linn.

Cape Natal bearing W. by N.; distant 6½ miles; depth, 54 fathoms.

Numerous examples.

DENTALIUM BELCHERI, Sowerby. Thes. Conch. Vol. III., page 101, plate 224, figs. 28, 29.

Off Buffels Bay, 30 fathoms; Cape Point Lighthouse bearing W. ¾ S.; depth, 35 fathoms, etc.

DENTALIUM NOVEMCOSTATUM, Lamarck.

Cape St. Blaize bearing N. by E. ¼ E.; distant 65 miles; depth, 85—90 fathoms.

DENTALIUM PLURIFISSURATUM, Sowerby *(Schizodentalium)*. Proc. Malac. Soc. Vol. 1, page 158, plate 12, fig. 24, 1894.

Cape St .Blaize bearing N.E. by E. ¼ E.; distant 67 miles; depth, 90 to 100 fathoms, and N., 30 miles, 55 fathoms. In fine sand.

In my original description of *Schizodentalium plurifissuratum*, I remarked that the strange feature of a series of fissures on the convex side was subject to considerable variation; the type having 5 such fissures; mention being made of one with 4, and one with only 2. The South African specimens present such a remarkable variation in this respect that I can no longer consider it a generic character. Some of the shells before me, although undoubtedly belonging to one and the same species,

have only one or two slits or fissures, varying in length and width, while others have absolutely none. In my description of *D. Africanum* in this paper, I have remarked that the apical slit is a very unreliable character in distinguishing species of this genus. This is fully confirmed in the case of the species under consideration.

SCAPHANDER PUNCTO-STRIATUS, Mighels. Proc. Boston Soc. Nat. Hist. Vol. I., page 49, 1841.

Vasco de Gama Pk. bearing S. 75° E.; distant $13\frac{1}{2}$ miles; depth, 166 fathoms; and Lion's Head N. 63° E., 34 miles, 154 fathoms.

A single specimen of this little species, taken at each of these stations. It has been found as far north as Iceland, and as far south as the Gulf of Mexico, but I believe it has never hitherto been found anywhere in the neighbourhood of South Africa. Pilsbry remarks (Man. of Conch., Vol. XV., p. 246) that this species inhabits comparatively shallow water in the north, but the southern localities are all for examples dredged in great depths. However it is interesting to note that much further south it is found again in what we may call *comparatively* shallow water; for although we may call 154 fathoms deep water, it is shallow compared with 533 fathoms, the depth at which the species was found in the Gulf of Mexico, and 1,000 fathoms, where it was dredged off the Azores.

---

[PUBLISHED 8TH JULY, 1903.]

long, acute; whorls 9, rather squarely convex, without spiral sculpture, rather slopingly and narrowly tabulated at the top; ribs numerous, about 20 on the penultimate, and 14 on the last whorl, moderately thick, and very slightly reflexed, with short angular spines at the angle. Last whorl short, rounded, without basal ridge, and with the umbilicus nearly closed. Aperture roundly oval; interior brown; peristome rather thick, smooth, slightly expanded and reflexed at the left anterior side, the posterior angle produced into a short angular spine.

Length 15; width 6 millim.

Hab.:—Cape St. Blaize bearing N.; distant $7\frac{1}{2}$ miles; depth, 37 fathoms. Bottom, fine sand. Also, Lat. 34° 7' S., Long. 25° 43' 30" E.; depth, 55 fathoms. Bottom, rock.

Only two specimens of this species were taken, one in each of the localities indicated.

The shell is somewhat similar in form to *S. aculeata*, but with more angular whorls. The brown colour is rather unusual.

ASTRALIUM (CYCLOCANTHA) GILCHRISTI (Plate V., fig. 6). Shell trochiform, slightly iridescent, the nacre being partly visible on the surface through the very thin covering, promiscuously spotted with reddish brown. Spire regularly conical, moderately high; whorls 6, sloping, scarcely convex, angularly keeled above and below, ornamented with rather close-set rows of bead-like pustules (6 on the penultimate whorl), interstices obliquely roughly plicate on the penultimate and last whorls; concavely channelled below the suture, the channel obliquely plicated. Last whorl with the peripherial angle armed with 16 hollow angular spine-like scales; angled below the periphery with a narrow slightly-raised keel, which is furnished with numerous very short scales; between the two angles are two or three rows of pustules, and beneath the second angle the base is slightly flattened and furnished with 6 rows of pustules or beaded ridges. The whole of the base is closely plicately laminated. Umbilicus completly closed by a thick white callus. Aperture oblique, rounded, width slightly exceeding the length; columella obliquely arcuate, covered with a thick smooth white callus; outer lip thin at the edge, interior smooth, silvery.

Operculum sub-circular, very thick, convex outside, white, very faintly granulose, with a very narrow groove at the outer margin.

Length $27\frac{1}{2}$; width 29 millim.

Hab.:—O'Neil Peak (Natal) bearing N.W. $\frac{1}{4}$ W.; distant $9\frac{1}{2}$ miles; depth, 90 fathoms. Bottom, broken shells. Also, Scottsburg Lighthouse (Natal) bearing N.W. by N.; distant 8 miles; depth, 92 fathoms. Bottom, sand and shells.

A strikingly beautiful shell, allied to *Turbo henicus*, Watson, from which it differs in detail, chiefly in the sutural channel, and in the more numerous scale-like spines at the periphery.

CALLIOSTOMA PERFRAGILE (Plate V., fig. 3). Shell trochiform, very thin, pale iridescent. Spire acutely conical; whorls 7, slightly convex, spirally ridged; ridges 9 on the penultimate whorl, rather narrow, the upper ones minutely granulated. Last whorl angled at the periphery, with a slight keel, which is articulated with rather distant oblong yellowish brown spots; base rather convex, faintly lirate near the margin, the liræ gradually becoming more prominent towards the centre. Aperture quadrangular, slightly oblique; columella very little curved, rather thick, truncated at the base.

Length 20; width 20 millim.

Hab.:—Vasco de Gama Pk. bearing S. 75° E.; distant 13½ miles; depth, 166 fathoms. Also, Lion's Head bearing N. 63° E.; distant 34 miles; depth, 154 fathoms.

In form this shell resembles *C. ornatum*, Lamk., but it is remarkable for its very thin fragile substance.

CALLIOSTOMA (LISCHKEIA) GRANOLIRATUM (Plate V., fig. 7). Shell angularly conical, width and length nearly equal, white. Spire moderately elevated, almost flatly sloping; whorls 6, plicately laminated, the laminæ scarcely discernible on the upper whorls, become more distinct on the lower; ornamented with small erect, slightly angular nodules in three rows, the two upper rows being rather distant, while the lower, just above the suture, is almost close to the middle one, and has much smaller and closer nodules. Last whorl obtusely bi-angular at the periphery, the nodules becoming arched scales; base rather convex, with 4 prominent rounded liræ, and a fifth narrower one bordering the umbilicus. The liræ are obliquely plicated, so as to give them the resemblance of twisted cords. Umbilicus narrow, almost covered. Aperture irregularly sub-quadrate, about equal in width and length; columella margin covered with a thick duplicate callosity forming a ridge against the umbilicus, rather straight in the middle, obliquely arched at the base and continuous with the outer lip. Interior smooth, silvery.

Length 11; width 11½ millim.

Operculum very thin, round, light, corneous, multispiral.

Hab.:—Cape Point, False Bay, bearing N.W. by W. ½ W.; distant 7¾ miles; depth, 45 fathoms.

This beautiful little shell is very like a miniature of *C. moniliferum*, Lamarck (= *Alwinæ*, Lischke), to which Mr. Pilsbry gave the sub-generic name of Lischkeia

Calliostoma (Astele) iridescens (Plate V., fig. 4). Shell angularly conical, thin, yellowish iridescent, here and there blotched with brown, particularly at the angle. Spire rather high, acutely conical; whorls 7, upper ones densely granulated, the rest spirally lirate, liræ (6 on the penultimate whorl) flattened, and intersected by one or two shallow grooves, the upper one or two slightly granulated. Last whorl broad and short, slightly convex, sharply carinated at the periphery; liræ more numerous and less regular, thin and crowded in proximity to the angle; base flatly convex, closely spirally ridged, and transversely striated. Umbilicus deep, rather narrow, bordered by an arched, slightly-raised ridge. Aperture obliquely quadrangular, lateral angle rather acute; columella short, truncated, arched, callous, with a thin lamina projecting slightly over the umbilical orifice; outer lip thin, interior silvery.

Length 16; width 17 millim.

Hab.:—Cape Natal bearing N. ½ W.; distant 4½ miles; depth, 55 fathoms.

Solariella persculpta (Plate V., fig. 8). Shell angular, abbreviately conical, white, width greater than the length. Spire broadly conical, rather acute; whorls 5, the first smooth, the second slightly angular in the middle, closely longitudinally plicated, the rest concave at the top, then biangular, the upper angle being coronated with erect angular tubercles, the lower sharply carinated and very closely plicately laminated at the keel; below the keel is a deep concavity, bordering which at the suture of the penultimate whorl may be observed another narrow keel, bearing small angular tubercles or scales. Last whorl broad, rather compressed, with a prominent laminated keel at the periphery, the nodules on the upper angles becoming less prominent; base compressly convex, with four rather distant keels; umbilicus deep and round, of moderate width, nodulously plicate and lirate at the entrance. Aperture obliquely quadrangular; peristome, thin, continuous, with a sharpish angle on the right side, corresponding with the external keel.

Length 8; width 9 millim.

Hab.:—Cape Natal bearing N. by E.; distant 24 miles; depth, 440 fathoms. Bottom, sand. (Only two specimens found.)

Minolia (Nachæroplax) congener (Plate V., fig. 2). Shell rather depressly orbicular, smooth, shining, light yellowish, suffused with light brown, ornamented with waved zigzag and acutely angular light and dark brown streaks. Spire depressly conical; whorls 5½ convex, moderately sloping, smooth, with only here and there very faint traces of obsolete spiral striæ; suture

rather deeply channelled; last whorl broad, convex above with small erect slightly angular nodules in three rows, the two rounded at the periphery, depressly convex at the base; umbilicus rather large, round and deep, bordered on the outer edge by an obtuse angle, a second angle appearing a little way within the orifice; the space between the two angles is slightly flattened, numerous very distinct close-set plicæ traverse this space, crossing the angles. Aperture rather large, peristome thin, columella margin straight, forming an angle where it joins the basal lip; outer lip sloping above, rounded at the base.

Length $9\frac{1}{2}$; width $15\frac{1}{2}$ millim.

Hab.:—Cape Infanta bearing N., $\frac{1}{4}$ W.; distant 82 miles; depth, 40 fathoms. Also Cape St. Blaize bearing N.; distant $7\frac{1}{2}$ miles; depth, 37 fathoms. Bottom, fine sand.

In general aspect, colour, and markings this shell closely resembles *M. lævissima*, Von Martens, from which it may be readily distinguished by the curiously distinct and crowded plicæ entering the umbilicus, which is smaller, and defined by a much more distinct angle.

The operculum is thin, concave, and multispiral, with a raised lamina at the suture of the whorls.

DENTALIUM INFLEXUM (Plate V., fig. 11). Shell rather narrow, much curved, considerably attenuated towards the apex, shining, fulvous, with irregular narrow bands of a darker colour, and slightly impressed growth lines; longitudinally very finely and closely striated, the striæ becoming gradually obsolete on the lower half of the shell.

Length 50; width at the aperture 4, and at the apex 1 millim.

Hab.:—Tugela River Mouth (Natal) bearing N.W. by W.; distant $3\frac{1}{2}$ miles; depth, 14 fathoms. Bottom, rock.

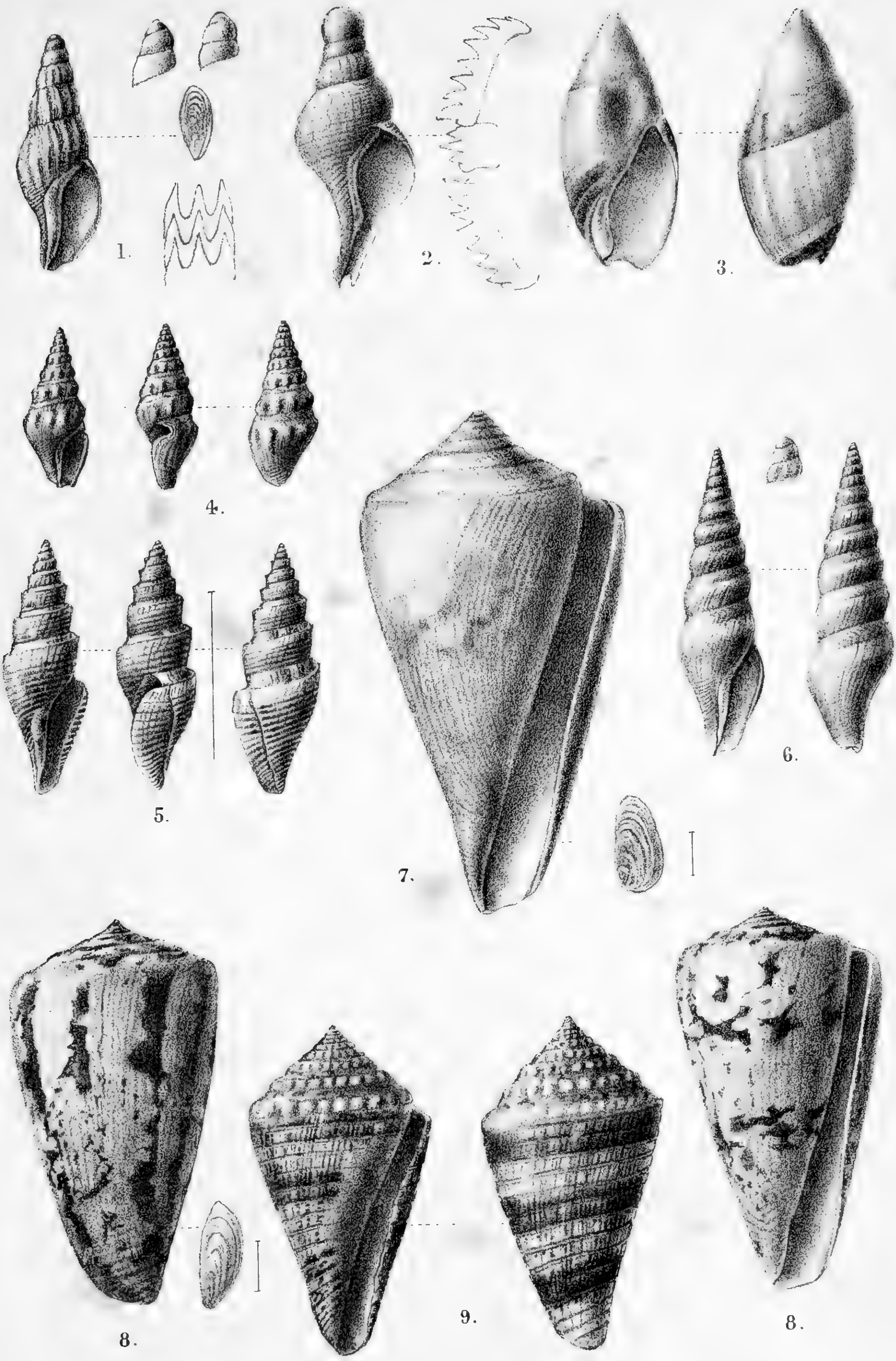
This shell differs from *D. longitrorsum*, Reeve, chiefly in being finely striated, and in having colour rings at irregular intervals, giving it an articulated appearance.

DENTALIUM AFRICANUM (Plate V., fig. 10). Shell rather stout, very little curved, white, with growth lines rather close, impressed, irregular, otherwise smooth; apical notch on the convex side, V shaped at the top, and descending in a rather narrow slit.

Length 46; width at aperture 5, at the apex $1\frac{1}{2}$ millim.

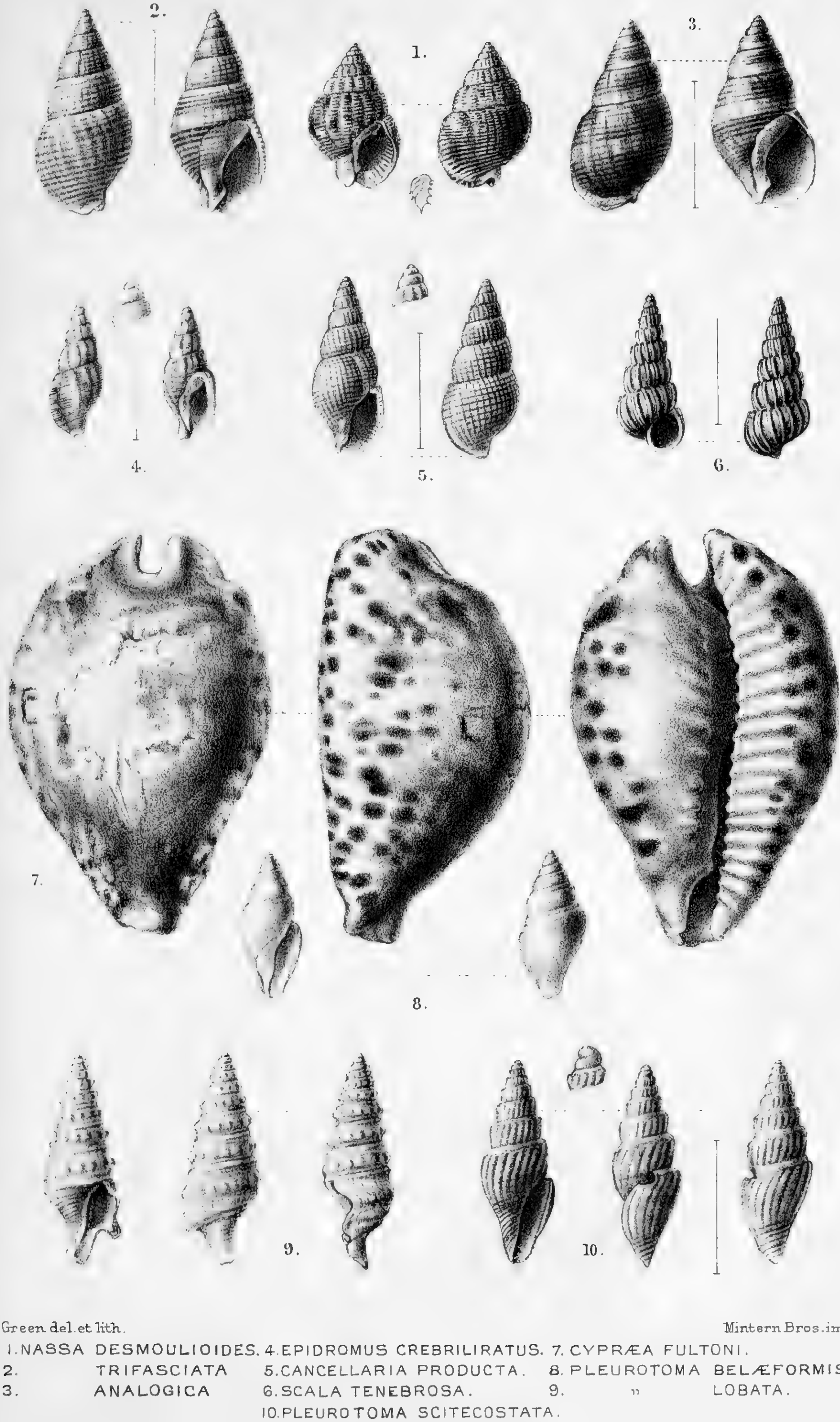
Hab.:—Red-topped Hill, W. of Untwalumi River (Natal) bearing N. by W.; distant 2 miles; depth, 25 fathoms. Bottom, broken shells.

The shell looks very like a large *D. entalis*, and forms a link between H. and A. Adams' sub-genus *Antalis* and Fischer's s.g. *Fissidentalium*. After a considerable study of the *Scaphopoda*,



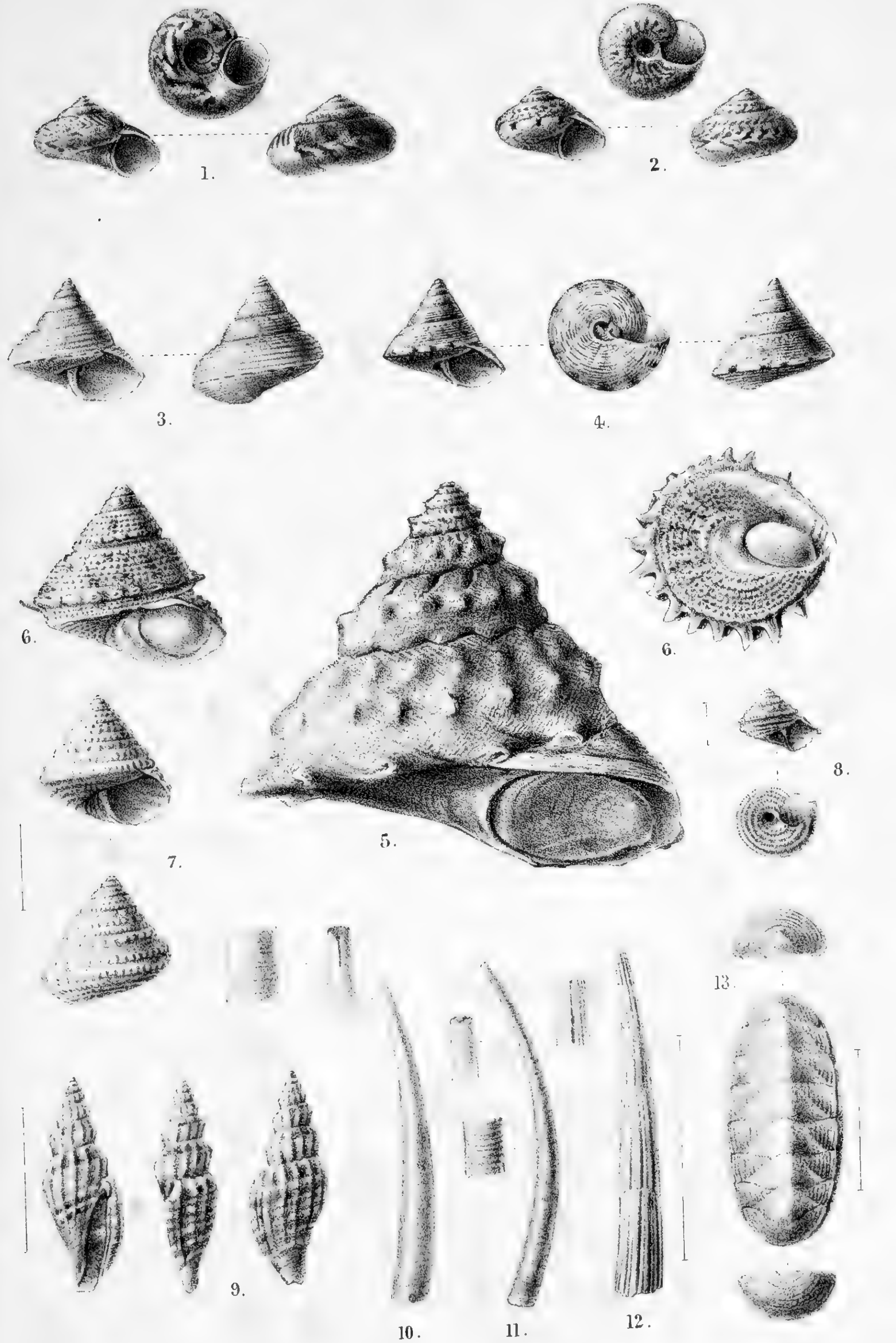

J. Green del. et lith. Mintern Bros. imp.

1. NEPTUNEOPSIS PYRRHOSTOMA. 4. PLEUROTOMA LIGNARIA. 7. CONUS PATENS.
2. FASCIOLARIA RUTILANS. 5. " FOSSATA. 8. " GILCHRISTI.
3. ANCILLA CONTUSA. 6. " TURRIPLANA. 9. " EUCORONATUS.




J. Green del. et lith. Mintern Bros. imp.

1. NASSA DESMOULIOIDES.
2. " TRIFASCIATA
3. " ANALOGICA
4. EPIDROMUS CREBRILIRATUS.
5. CANCELLARIA PRODUCTA.
6. SCALA TENEBROSA.
7. CYPRÆA FULTONI.
8. PLEUROTOMA BELÆFORMIS.
9. " LOBATA.
10. PLEUROTOMA SCITECOSTATA.



J. Green del. et lith.

Mintern Bros. imp.

1. MINOLIA LÆVISSIMA.
2. " CONGENER.
3. CALLIOSTOMA PERFRAGILE.
4. " IRIDESCENS.
5. ASTRALIUM ANDERSONI.
6. ASTRALIUM GILCHRISTI.
7. CALLIOSTOMA GRANOLIRATUM.
8. SOLARIELLA PERSCULPTA.
9. MANGILIA AFRICANA.
10. DENTALIUM AFRICANUM.
11. " INFLEXUM.
12. " EXASPERATUM.
13. CHITON SYKESI.

# DESCRIPTIONS

OF

# SOUTH AFRICAN SPONGES

## PART III.

BY

R. KIRKPATRICK, F.Z.S.

BRITISH MUSEUM (NATURAL HISTORY).

---

In the present paper the Monaxonida and Keratosa, obtained by Dr. J. D. F. Gilchrist from Cape Colony and Natal, are described. The collection comprises 61 specimens, representing 33 species and 3 varieties, of which 19 species and all the varieties are new; of the genera, one is new to science. Among the points of special interest are the following: (1) the occurrence of a large and massive new species of *Placospongia* characterised by a great development of the internal skeletal partitions; (2) a new stalked species of *Latrunculia* near *L.* (*Podospongia*) *lovenii* Bocage; (3) a new Spirastrellid genus near *Spirastrella* but with an ectosomal crust of euasters in place of spirasters.

With regard to geographical distribution, 3 species (*Tragosia infundibuliformis* (J); *Sollasella hystrix* Topsent; *Halichondria pachastrelloides* Topsent) are common to the North Atlantic and Natal. Two species (*Latrunculia lovenii* Bocage, and *Histoderma appendiculatum*, Carter) from the North Atlantic very nearly resemble the Natal species *Latrunculia natalensis* sp. n., and *Histoderma natalense* sp. n., respectively. *Hamacantha esperioides R.* and *D.* is common to Cape Colony and Rio de la Plata. Three species (*Clathria typica*, Carter; *Hircinia arensa*, Lendenfeld; and *Hircinia arbuscula*, Lendenfeld) are common to Australia and South Africa. From these few data no conclusions can be drawn, though it may be mentioned that Carter has drawn attention to resemblances

between the sponge fauna of South Africa and Austr[illegible]a. The following is a list of the species :—

Order **MONAXONIDA**

Sub-Order HADROMERINA.

Section I. **CLAVULIDA.**

Family **Placospongidæ.**

**Placospongia labyrinthica,** sp. n.

Family **Spirastrellidæ.**

**Latrunculia natalensis,** sp. n.
**Kalastrella vasiformis,** gen. et sp. n.
**Kalastrella vasiformis,** var. *minor*, var. nov.

Section II. **ACICULIDA.**

Family **Coppatiidæ.**

**Coppatias baculifer,** sp. n.

Family **Tethyidæ.**

**Tethya magna,** sp. n.
**Trachya nuda,** sp. n.

Sub-Order HALICHONDRINA.

Family **Axinellidæ.**

**Hymeniacidon caliculatum,** sp. n.
**Hymeniacidon caliculatum,** var. *osculatum*, var. nov.
**Phakellia microxephora,** sp. n.
**Tragosia infundibuliformis** (Johnston), var *natalensis*, var. nov.
**Axinella,** sp.
**Axinella,** sp.
**Syringella gorgonioides,** sp. n.
**Axinyssa tethyoides,** sp. n.
**Sigmaxinella arborea,** sp. n.
**Sigmaxinella incrustans,** sp. n.
**Higginsia bidentifera** (Ridley and Dendy).
**Sollasella hystrix** (Topsent).

Family **Poeciloscleridæ.**

Sub-Family **Bubarinæ.**

**Bubaris reptans**, sp. n.

Sub-Family **Ectyoninæ.**

**Clathria typica** (Carter).
**Clathria mollis**, sp. n.
**Stylostichon involutum**, sp. n.

Sub-Family **Dendoricinæ.**

**Histoderma natalense**, sp. n.
**Dendoryx incrustans** (Esper).

Sub-Family **Esperellinæ.**

**Desmacidon ramosum** (Ridley and Dendy).
**Desmacidon grande** (Ridley and Dendy).
**Hamacantha esperioides** (Ridley and Dendy).

Family **Haplosceridæ.**

Sub-Family **Renierinæ.**

**Phlœodictyon eumitum**, sp. n.
**Reniera**, sp.
**Halichondria pachastrelloides** (Topsent).

Order **KERATOSA.**

Family **Spongidæ.**

Sub-Family **Eusponginæ.**

**Coscinoderma concentricum**, sp. n.

Sub-Family **Stelosponginæ.**

**Stelospongia**, sp.
**Hircinia arenosa** (Lendenfeld).
**Hircinia arbuscula** (Lendenfeld).

Family **Spongelidæ.**

**Psammopemma inordinatum**, sp. n.

## Family **Placospongidæ.**

### Genus **Placospongia** (Gray).

### **Placospongia labyrinthica,** sp. n.

Plate V., Fig. 1, 1a, 1b. Plate VI., Fig. 1a-f.

Sponge massive. The small circular oscules, .75 mm. in diameter, restricted to circular, oval, or irregular plaques with slightly raised margin and depressed area, the plaques being for the most part aggregated over a certain area.

Circular pores, .4 mm. in diameter, more or less uniformly distributed over an extensive rough hummocky area. The surface, where it is devoid of pores and oscules, quite smooth.

Colour of specimens (in spirit), pale yellow, with a faint purplish tinge over the oscular areas.

Skeleton composed of a dense pseudo-sterrastral cortex, and of labyrinthine walls of the same structure dividing the body mass into numerous cavities, some being small and spherical, others large and elongated. Sterrasters scattered in the soft tissues, also megascleres and microscleres.

Spicules. Megascleres.—Sub-tylostyle, or style thickened at the base, 2125 × 36 $\mu$, slightly curved, gradually tapering from the base to the usually blunt point.

Oxea and strongyle, 2425 × 45 $\mu$, curved at the centre.

Sterrasters varying in size up to 160 × 100 $\mu$, ellipsoidal.

Microscleres.—Somal chiaster 16 $\mu$, with 9-11 actimes and a small centrum.

Another kind (not figured), 32 $\mu$ in diameter, with five roughened truncate actines and a small centrum.

Pycnaster (or small spheraster), mostly ectosomal, 6 to 14 $\mu$ in diameter.

Locality A.—East London coast, 85 fathoms.

This remarkable species is represented by two large massive specimens. The first is massively flabellate, slightly cleft at the thick rounded margin so as to form three thick lobes; the height is 10 cm., the width 14 cm., and thickness 8 cm. The oscular areas vary from 1 to 2.5 cm. in diameter; a ridge surrounds the extensive poral area. The second specimen, which slightly resembles in shape a kneeling camel, is 11 cm. in thickness; a sharp "dorsal" ridge runs along the upper edge; one side (the "near" side) is smooth and imperforate; the other is provided with oscular plaques over one-half, while the rough poral region occupies the other.

Both specimens have been torn from their attachment and reveal at their bases the broken labyrinthine cavities.

I was unable to find a definite sterrastral axis. On making vertical sections, the smaller spherical chambers were in one

place at the base of the sponge, and in another near the periphery. The walls of the larger cavities branched in a dichotomous manner. The smallest cavities were 1 cm. in diameter, and the largest 5 × 2.5 cm. in size. The average thickness of the partition walls was about 3 mm., but in one place the cortex attained a thickness of 1.5 cm. The distinctive features of the species are the labyrinthine skeleton, the presence of chiasters, and absence of spirasters.

The other species of this genus (*P. carinata* Bowerbank; *P. melobesioides* Gray; *P. intermedia* Sollas; *P. decorticans* Hanitsch; *P. mixta* Thiele) all possess well-marked tyles.

The presence of chiasters is so exceptional that I thought at first that I had to deal with a Geodine sponge, but there were no triaenes to be found.

### Genus **Latrunculia** (Bocage).

### **Latrunculia natalensis**, sp. n.

Plate V., Fig. 2. Plate VI., Fig. 2a-e.

Sponge small, with long slender stalk and pyriform head with an oscule at the summit surrounded by a fringe of spicules. Surface (when viewed through a lens) slightly hirsute. Colour sandy. Skeleton formed of an axial stalk projecting about half way into the body, and of spicule bundles radiating out from a point below the centre; ectosome formed of a thick crust of sterrasters. Discasters of two kinds, somal and choanosomal.

Spicules. Megascleres.—Styles (rare) 700 × 10 $\mu$, smooth, slightly curved.

Strongyle 500 × 23 $\mu$, slightly curved near the centre.

Amphioxea or tornote in bundles and forming the oscular fringe) 540 × 10 $\mu$, frequently pointed abruptly at one end and gradually at the other.

Microscleres.—Somal discaster, total length and breadth 36 × 23 $\mu$; with a basal verticil of four simple spines, two large central oppositely directed verticils of compound spines, and a small verticil of simple spines appressed to the apical spine.

Choanosomal discaster with simple spines, 86 $\mu$ long, with two oppositely directed verticils each composed of four simple spines 21 $\mu$ long.

Locality E.—Cone Point, Natal, 34 fms.; growing attached to *Tethya magna*.

The one specimen is 19 mm. in length, the head being 4·5 mm. in length by 2 mm. in breadth.

The resemblance, both in form and spiculation, to *Podospongia lovenii*, Bocage, [1, p. 159, pl. x., fig. 1] is so close as to suggest that the new form should be regarded merely as a variety of the latter. The North Atlantic species is without the large discasters with simple spines, which are plentifully scattered in the choanosome of the new species; and the somal discasters (40 × 20 μ), in Bocage's species, are longer and more slender, and with the superior verticil of simple spines almost or entirely fused with the terminal spike, which is often bifurcated; lastly, the styles are abundant and straight in *P. lovenii*.

## Family **Spirastrellidæ.**

### **Kalastrella,** gen. nov.

*Spirastrellidae* pedicellate, vasiform or sub-caliculate, with tyles, styles, and oxeas for megascleres, and for microscleres euasters forming an ectosomal layer and distributed in the body.

### **Kalastrella vasiformis,** sp. n.

Plate V., Fig. 3. Plate VI., Fig. 3a-f.

Sponge vase-shaped, pedicellate, the wall being formed of a network with narrow longitudinal meshes, with the strands mainly composed of styles and oxeas, with small bundles of the same projecting out at right angles to the outer surface.

Surface (in the specimens) partly covered with a pale yellowish white cortex, composed of asters leaving the glassy-looking skeleton, visible in places, especially at the upper half of the sponge.

Spicules. Megascleres. — Tyle (or sub-tylostyle), length 128 μ by 5 μ, often with one or two sharp prickles at the summit.

Style, 2150 × 50 μ, curved about the middle.

Strongyle, 1762 × 54 μ, curved at the middle.

Oxea, 2150 × 50 μ, curved at the middle.

Microscleres.—Euasters of all sizes up to 30 μ with centrum of 8 μ, with about 10 stout, blunt, roughened actines.

Locality C.—Mouth of Tugela River, 65 fms.; bottom, hard ground.

The new genus comes near *Spirastrella*, the ectosomal layer of spirasters of the latter being replaced by euasters (hence the generic name).

The three specimens of the new species are of about the same size and shape; the height is 2 cm., diameter of mouth

2 cm., length of stalk .5 cm., and thickness of wall about 1.2 mm., not including the glassy bristles which extend about 1 mm. beyond the outer surface.

The specimens, which look like small Hexactinellids, are probably in an early stage of growth, and, if this be so, would possibly grow to resemble, in outward appearance, the variety described below.

**Kalastrella vasiformis**, var. *minor.*

Plate V., Fig. 4. Plate VI., Fig. 4a-c.

Sponge pedicellate, sub-caliculate, with a finely papillated surface of greyish purple hue. Pores in cribriform areas between the papillae on the outer surface; oscules 1 mm. in diameter on the inner surface.

Spicules. Megascleres.—Tyles (rare) as in the typical form. Oxeas and styles of uniformly smaller size than in the type; style 860 × 26 $\mu$; oxea, 1200 × 26 $\mu$.

Microscleres.—Euasters of all sizes up to 60 $\mu$ in diameter, with centrum 11 $\mu$, similar in character to those of the typical form.

Locality E.—Cone Point, Natal; depth, 34 fms.; bottom, broken shells.

The one specimen is shaped like a funnel incomplete on one side, the height being 7 cm., width 2.5 cm., and thickness of wall 4 cm. The stalk is 2.5 cm. in length and 8 mm. in thickness.

It might be supposed that the variety was merely the fully grown condition of the typical form, and that in course of growth the ectosome of the latter would become much thicker and darker; but apart from the differences in form and colour, the uniform and great difference in size of the oxeas and styles, which are much smaller in the variety, constitutes a well-marked varietal distinction.

## Family **Coppatiidæ.**

### Genus **Coppatias** (Sollas).

**Coppatias baculifer**, sp. n.

Plate V., Fig. 5. Plate VI., Fig. 5a, b.

Sponge massive, irregular in shape. Surface rough; texture hard, almost stony; colour, in dry state, reddish brown; lighter in section. Oscules 1-2 mm. in diameter, forming irregular cribriform areas; pores not visible.

Skeleton consisting of a confused mass of oxeas of various sizes, and of somal microstrongyles, which form a thin but compact dermal layer.

Spicules. Megascleres.—Oxeas of various sizes, from $360 \times 9$ μ to $1550 \times 62$ μ, curved, often slightly centrotylote.

Locality K.—Durnford Point, Natal, 90 fms.; bottom, broken shells.

The new species is represented by one specimen, which is firmly attached by a large base to *Stelletta horrens*, Kirkp. The dimensions are $8 \times 9 \times 9$ cm.

For the most part the dermal layer has disappeared, the eroded surface showing matted masses of spicules (oxeas).

The new species possesses microstrongyles, usually centrotylote, these being probably modified euasters.

In the genus *Coppatias*, as defined by Sollas, only one form of aster, the euaster, occurs; accordingly an enlargement of the definition is necessary, if it is to include the present species. The new definition of *Coppatias* would run :—*Coppatiidæ*, with megascleres without order; the microscleres being either euasters or microstrongyles.

### Genus **Tethya** (Lamarck).

### **Tethya magna**, sp. n.

Plate V., Fig. 6. Plate VI., Fig. 6a-d.

Sponge oval or spherical, attached at the base by banyan-tree-like rootlets, surface with well-marked conules in the young state, expanding later into polygonal plates.

Cortex including intercortical cavities.

Pores in cribriform groups between the conules over certain areas; oscules not visible.

Colour, in spirit, purple-brown; on section, cortex silvery, pith bright yellow.

Spicules. Megascleres.—Strongyloxea $4805 \times 75$ μ.

Microscleres. Cortical spherasters 60-110 μ in diameter, sharp conical actines about 35 μ.

Somal chiasters 12-17 μ, with a relatively large centrum about 6 μ; usually with six actines with spinous truncate ends.

Choansomal asters 35-45 μ in diameter, with centrum about 5 μ; usually with 6 or 7 actines, truncate, bent at the extremity, and with rough surface.

Locality E.—Cone Point, Natal, 34 fms.; bottom, broken shells.

There are three specimens, the two smaller being oval with their long diameter, 4 and 6 cm.; the largest specimen, which is spherical, is 7 cm. in diameter. The new species belongs to

the series, *T. ingalli, seychellensis, maza,* and *japonica,* the last three of which Sollas is inclined to regard as varietal modifications of a single species.

The megascleres of the Natal species are much larger than those of the other forms ; also the spherasters are larger. The measurements are given below in microns :—

| | *T. magna.* | *T. ingalli.* | *T. seychellensis.* | *T. maza.* | *T. japonica.* |
|---|---|---|---|---|---|
| Strongyloxeas | 4805×75 | 1700×32 | 1910×23 | 1680×32 | 1510×26 |
| Spherasters | 120 | 85 | 95 | 55 | 67 |

Genus **Trachya** (Carter.)

**Trachya nuda,** sp. n.

Plate V., Fig. 7. Plate VI., Fig. 7a, b.

Sponge massive ; without a cortex ; surface partly smooth, partly finely papillate ; pores not visible ; a few minute oscules at the ends of small conical papillae.

Colour, in spirit, pale brown, lighter in the interior ; the ground-substance tough-gelatinous, semi-transparent. Consistence rather hard, but sponge easy to cut with a knife.

Skeleton formed of long ill-defined bundles of oxeas radiating from the attached base to the surface.

Spicules.—Oxea, 1700 × 45 $\mu$, curved at the centre, gradually attenuating to sharp points.

Locality E.—Cone Point, Natal, 34 fms. ; bottom, broken shells.

The single specimen forms a rounded mass rising from a broad base ; it is 5 cm. in height, 6 cm. in thickness, and 6 cm. in length.

The new species differs from *Trachya pernucleata Cr.* and *T. horrida Cr.* in being devoid of a cortical palisade of diactinal microscleres.

Both in outward appearance, in section, and skeletal arrangement this sponge bears a remarkable resemblance to *Trachya durissima,* Carter, from the Cape ; the latter, moreover, becomes comparatively soft on immersion in water, while *T. nuda* becomes very hard on drying. There is, however, a great difference in the spiculation, Carter's species having styles—but not tylostyles—and coming under the Suberitid family of the Clavulida [Topsent, 18, p. 111].

Genus **Hymeniacidon** (Bowerbank).

**Hymeniacidon caliculatum,** sp. n.

Plate V., Fig. 8. Plate VI., Fig. 12.

Sponge stipitate, sub-caliculate. Surfaces slightly rough from

the projection of vertical tufts of spicules, and showing beneath the reddish dermal membrane, a fine lace-like reticulum. Pores and oscules not distinguishable

Skeleton, a network with rectangular meshes, .1 × .05 mm. in diameter; the meshes arranged serially and longitudinally in a central lamina; but on each side of the central lamina meshes with the long diameter more or less vertical to the lamina and sponge surface; strands of long sides of meshes 5 to 10 spicules thick, of short sides 2 to 3.

Spicules.—Style, 225 × 12 $\mu$, smooth, curved at junction of upper and middle third.

Colour brick-red, with here and there small patches of blue on the outer surface where the latter has been bruised by pressure.

Locality A.—East London coast, 85 fathoms.

The one specimen is 21 cm. in height by 12 cm. broad, and 1 cm. thick. The rounded stalk is 5.5 cm. in height by 2 cm. in thickness. The stalk grows into a sub-caliculate flabellate expansion, the shallow cup at the summit of the stalk being 1.5 cm. deep.

The skeleton shows well the transition between the Renierid and Axinellid type.

**Hymeniacidon caliculatum,** var. *osculatum.*

Plate VI., Fig. 13.

The sponge is brick-red in colour and forms a flat flabellate expansion 19 cm. in height by 17 cm. in breadth and 7 mm. in thickness, rising from a broad, short stalk.

One surface is covered with small oscular depressions 2 mm. in diameter. The spicules are styles 200 × 16 $\mu$; they are shorter, thicker, and more curved than in the type.

Locality A.—East London coast, 85 fathoms.

Genus **Phakellia** (Bowerbank).

**Phakellia microxephora,** sp. n.

Plate V., Fig. 9. Plate VI., Fig. 9a-d.

Sponge stipitate, forming a thin, flat flabellate expansion, which in the thinner peripheral parts is seen to be composed of a very close-meshed network, covered on both surfaces by a close pile of vertical tufts; on one surface white-branched bands apparent.

Smaller circular orifices about 1 mm. in diameter on both surfaces.

Spicules. Megascleres.—Vermicular strongyles, abundant, 670 to 1250 × 12 to 16 $\mu$, smooth.

Oxea (rather rare) 620 × 18 μ, curved near the centre.

Style (rare) 560 × 20 μ.

Microscleres.—Microxeas, abundant, 70 × 3 μ, slightly curved at the centre.

Colour in spirit, pale yellow.

Locality A.—East London coast, 85 fathoms.

The one specimen, of which half has been sent, is 22 cm. in height and the same in breadth, and the flattened stalk is 4 cm. in height and 3 cm. in thickness.

The characteristic feature of the new species is the presence of microscleres in the form of microxea.

The new species is a typical *Phakellia* in all respects, excepting in the occurrence of the microscleres ; if, however, the presence of these spicules should render necessary the establishing of a new genus, the latter would come between *Higginsia* and *Phakellia*.

### Genus **Tragosia** (Gray).

**Tragosia infundibuliformis** (Johnston), var. *natalensis*, var. nov.

Plate V., Fig. 10. Plate VI., Fig. 10a-c.

There are two small cup-shaped specimens of a new variety of Johnston's species, each 3 cm. in height, 3 cm. in diameter at the mouth, and with walls 1.5 mm. in thickness ; their colour is pale yellow.

In the new variety there is a dermal skeleton composed of bundles of spicules arranged tangentially to the surface, but the vertical tufts which project from the surface in Johnston's type are almost absent.

The spicules are straight styles (very rare), 450-1200 × 12-13 μ, narrowed at their base to 10 μ ; and oxeas, 300 × 12 μ, slightly curved at the centre.

In Johnston's type (in the British Museum) the oxeas, about the the same size as the latter, have an abrupt bend at the centre ; and the style, which are very abundant and uniform in size, are only 285 × 13 μ, and curved. In spite of the variation in the styles, which have almost disappeared from the Natal variety, and of the much greater development of the dermal skeleton of the latter, this form seems to be only a well-marked variety of *T. infundibuliformis*, Johnston.

Localities.—C, off Tugela River mouth, 65-80 fathoms, hard ground ; and D, off Cape Vidal, Natal, 80-100 fathoms, rock.

### Genus **Axinella** (Schmidt).

**Axinella**, sp.

Sponge thick flabelliform, of the consistence of indiarubber,

*i.e.*, flexible and rather tough; marked with radiating ridges or series of conuli; colour, grey. A few small oscules, .75 mm. in diameter, scattered about; cortex absent; ground substance semi-transparent.

Skeleton formed of radiating bundles of large styles branched in a fan-like manner.

Spicules.—Large style, $1230 \times 22\ \mu$, curved at the junction of the upper and middle third.

Oxea, $620 \times 5\ \mu$, straight, sharp pointed.

Locality E.—Cone Point, Natal, 34 fathoms; bottom, broken shells.

The specimen, which is 6 cm. in height, 4 cm. in breadth, and .5 cm. in thickness, expands upwards from a thickened base which appears to have been cut off from its attachment. No specific name has been attached to it.

### **Axinella**, sp.

Sponge consisting of a simple, erect, unbranched stem-like growth of pale brick-red colour, and with a fluffy surface.

Skeleton formed of a dense axial core of styles, giving off tuft-like bundles which are directed obliquely upwards.

Spicules.—Style, $590 \times 28\ \mu$, with a sharp curve near the basal end.

Locality C.—Off Tugela River mouth, 65-80 fathoms; bottom, hard ground.

The specimen is 5.5 cm. in height, by .5 cm. in diameter at the thickest central part. The stem above its attachment is at first smooth, but soon becomes tufted.

The sponge is shaped like a cypress tree, the stem being at first smooth, then tufted, and terminating in a point. The species is near *Axinella erecta*, Carter, which occurs in the South Atlantic and Southern Oceans, but chiefly differs from the latter in the absence of the crooked strongyles.

The one specimen probably represents a new species, but is too immature to be made the type of a species.

### Genus **Syringella** (Schmidt).

### **Syringella gorgonioides**, sp. n.

Plate V., Fig. 11. Plate VI., Fig. 11a, b.

Sponge forming a thin flabelliform clathrate expansion, flexible but inelastic, spreading from a thick hard stem; surface rough and granular, slightly hirsute from projecting glassy

spicules (which show clearly on the borders of the meshes). Pores and oscules not discernible.

Colour, slaty-gray, bleaching to brown.

Skeleton formed of a dense axis of styles enveloped in spongin, with conical tufts of styles projecting from the axis at right angles and with the apices outwards.

Spicules.—Style, 340-530 × 12-25, usually curved near base or centre, or sometimes nearly straight, of the same thickness from base to junction of middle and lower third, then attenuating gradually to a sharp point.

Locality A.—East London coast, 85 fms.

There are two fine specimens of this species, the largest being 50 cm. in height and 19 cm. in width, the stem being 6 cm. in length and 2 cm. in diameter.

The meshes are elongated, and average about 1.5 × .5 cm.; the strands diminish in diameter from stem to periphery, but average about 2.5 mm. from side to side, and 3 mm. from before backwards.

There are two other clathrate species of *Syringella*, viz. S. clathrata, Ridley, and S. falcifera, Topsent; but the differences in general character and spiculation are so great that it is needless to specify them.

Genus **Axinyssa** (Lendenfeld).

**Axinyssa tethyoides**, sp. n.

Plate V., Fig. 12. Plate VI., Fig. 8a, b.

Sponge sub-spherical; surface covered with conical papillae about 4 mm. high, and easily detachable. Pores and oscules not visible; texture loose and friable.

Colour, in spirit, black outside, dark brown in the interior.

Skeleton consisting of dendritically branched fibres from 500-1000 $\mu$ thick, which can be easily detached from the loose flesh of the sponge, leaving tubular cavities; also loose oxeas scattered in the soft tissues.

Spicules.—Oxeas, varying in size, up to 700 × 34 $\mu$, sharp-pointed, slightly curved at the centre.

Locality E.—Cone Point, Natal, 34 fms.; bottom, broken shells.

The solitary specimen, which is sub-spherical, is about 6 cm. in diameter. At the flattened base is a deep depression, where apparently the sponge was attached. The new species calls to mind *Axinella tubulata*, Bowerbank [3, p. 29, pl. viii.], which is more or less spherical and has surface papillae; but there are no commensal worms in the new form, while the spicules are oxea, and not, as in Bowerbank's species, styles.

*Axinella (?) paradoxa,* Ridley and Dendy [15, p. 187], a small massively lobate sponge with oxeas for its spicules, would come under *Axinyssa,* which genus, with *A. topsentii.,* Lendenfeld [12, p. 116] includes three species.

### Sigmaxinella (Dendy).

### Sigmaxinella arborea, sp. n.

Plate V., Fig. 13. Plate VI., Fig. 14a-c.

Sponge erect, ramose, with long stem and long dichotomous branches, the lower ones compressed, the upper cylindrical. Surface formed by the apices of hispid tufts. Oscules scattered, very small, about 1 mm.

Colour (in spirit) pale brown.

Skeleton formed of a dense axis of reticulating fibres of spongin with megascleres, the tufts, simple or branched, radiating out horizontally from the axis.

Spicules. Megascleres.—Styles, 800-1150 × 25-37 μ, curved near the upper end, which is attenuated to 17 μ.

Strongyles, 700-870 × 25-30 μ.

Rhaphide-like oxeas (very rare) 825 × 12.5 μ, straight, slender.

Microscleres —Rhaphides solitary or as trichodragmas, slightly fusiform, 70 μ long.

Sigma 15 μ long and 1 μ thick.

Localities A, D, G.—East London, 85 fms.; Cape Vidal, Natal, 80-100 fms., bottom rocky; and O'Neil Peak, Natal, 55 fms., bottom broken shells.

There are three specimens, the largest being 31 cm. in height and 21 cm. in breadth, the stem being 12 cm. in length and 2 × 1 cm. in diameter.

The new species is very near *Sigmaxinella australiana,* Dendy [7, p. 240] which forms a bushy bunch of short slender branches. The main difference lies in the spiculation; the styles, for instance, in the Australian species are only 300 × 6 μ, and the raphides only 25 μ.

### Sigmaxinella incrustans, sp. n.

Sponge forming a pale-brown woolly-looking crust about 6 mm. thick.

Skeleton formed of branched plumose columns rising vertically from base to surface, the latter being covered with an ectosomal layer of microscleres. Spongin present, but not to a great extent.

Spicules. Megascleres.—Style, 1085 × 33 μ, being 31 μ at the base, with a gradual curve in the upper third.

Microscleres.—Sigma, 27.5 μ in length by 2.7 in thickness.
Rhaphides, 60 μ in length, solitary or in trichodragmata.

Locality A.—East London coast, 85 fms., encrusting *Placospongia labyrinthica*.

The new species differs from *S. arborea mihi*, not merely in its form but in comparatively slight development of spongin. The styles are markedly different in shape, those of *S. arborea* being much narrowed at the base. Further, the sigmas in the latter are very considerably shorter and more slender.

### Genus **Higginsia** (Higgins).

### **Higginsia bidentifera** (Ridley and Dendy).

1886. *Dendropsis bidentifera*, Ridley and Dendy [14, p. 483].
1887. Do. do. [15, p. 192, pls. xxxviii., xl., xlvi.]
1898. *Higginsia bidentifera*, Topsent [18, p. 93].

Four fine specimens of this species are in the present collection, the largest being 250 cm. in height, and with a stem 4 cm. thick.

The "Challenger" specimens were obtained from Simons Bay, 20 fms.

Locality A.—East London coast, 85 fms.

### Genus **Sollasella** (Lendenfeld).

### **Sollasella hystrix** (Topsent).

1892. *Trachya hystrix*, Topsent [16, p. 75, pl. i., figs. 8-10; and pl. xi., figs. 12-14].
1898. *Sollasella hystrix*, Topsent [18, p. 111].

One small specimen of this species occurs in this collection. The specimen is white in colour and pyriform, 2 cm. in height, and 1.3 cm. in its greatest width. No oscules are perceptible. On section, the cortical layer of microxeas shows us a well defined white line. In one point the present specimen differs from those described by Topsent; the slender oxeas in the choanosome are not only separate, but also united to form trichodragmata. The size of the spicules is as follows:—

Tyles 5270 × 64 μ, often with the base surmounted by a small rounded knob; microxea 165 × 6, smooth, straight, fusiform. Certain small tyles (170 × 5.5 μ) and asters present in the slides are very probably adventitious.

The type specimens came from 173.3 fms. and 247.5 fms. off the Azores.

Locality C.—Off Tugela River mouth, 65-85 fms.; bottom, hard ground.

### Genus **Bubaris** (Gray)

### **Bubaris reptans**, sp. n.

Plate V., Fig. 14. Plate VI., Fig. 15a-c.

Sponge encrusting, growing in the form of narrow sharp-edged ligulate bands averaging about 1 mm. in diameter, but wider at the origin of branches; the bands branching and occasionally anastomosing so as to form an incomplete reticulate pattern (on the surface of *Halichondria pachastrelloides*, Topsent).

Here and there minute oscular (?) papillae about .25 mm. high, only visible in the specimen preserved in formalin.

Colour, in spirit, greenish; in formalin, pale yellow with purple streaks.

Skeleton composed of a basilar layer of styles partly tangential, partly forming root-like fascicles proceeding obliquely downwards and outwards into the *Halichondria*, and of a dense superficial layer of vertically arranged tyles.

Spicules.—Style, 530 μ in length by 15 μ in breadth at the centre, and 9 μ in breadth at the base, fusiform, straight or slightly curved near the base.

Tyle, 16 × 6 μ, decidedly curved near the head; head subspherical, slightly knobbed at summit, 6.5 μ in diameter, neck 5 μ.

Microscleres, 0.

Locality E.—Cone Point Natal, 34 fms.; bottom, broken shells.

The new species is placed, not without hesitation, in the genus *Bubaris*, under which is grouped a somewhat heterogeneous collection of species.

There are no diactinal megascleres in the present species, which agrees in this respect with *B. constellata*, Topsent, in which last, however, oxyasters replace the typical basilar diactinal megascleres.

The small papillae on the surface are probably oscular, since it is possible to trace canals passing down in a radiate manner into the body of the sponge, the canals being mapped out by cells containing purple granules.

### Genus **Clathria** (Schmidt).

### **Clathria typica** (Carter).

1881. *Echinonema typicum*, Carter [4, p. 378].
1881. *Echinonema anchoratum*, Carter [4, p. 379].
1896. *Clathria typica*, Dendy [6, p. 32].

One small stalked flabellate specimen of this sponge, attached to a piece of rock, occurs in this collection. The height is

10 cm., the breadth 3.5 cm., the thickness of body 6 mm., and length of stalk 2 cm.

The surface is covered with small conical papillae, which show a radial tendency towards the periphery; the colour is brown.

The fibres of keratode are thick and rather hard. The megascleres are:—Smooth styles, 530 × 10 $\mu$, slightly curved near the base; echinating spined style, 120 × 10 $\mu$, straight; dermal styles, 250 × 11 $\mu$, spined at the base.

The microscleres are:—Toxa, 154 × 4 $\mu$, spined at the ends; slender palmate isochelae, 11 $\mu$ in length; thick contort sigmata, 65 × 3 $\mu$.

In the British Museum collection there are several thin stipitate flabellate specimens of this species from Port Elizabeth, labelled *Echinonema anchoratum, Cr.*

Locality E.—Cone Point, Natal, 34 fms.; bottom, broken shells.

Distiibution.—S. and S. W. Australia; Port Elizabeth and Natal.

### **Clathria mollis**, sp. n.

Plate V., Fig. 15. Plate VI., Fig. 16a-d.

Sponge forming a thick-walled soft sub-caliculate growth, with thick rounded rim.

Surface smooth. A few small circular oscules, 1-2 mm., scattered over both surfaces. Consistence like soft rubber.

Colour, grayish-brown, speckled with numerous whitish specks due to foreign particles, the latter being plentiful on the surface and in the interior.

Skeleton formed of a network of very thick, soft fibres of spongin, sometimes cored with spined styles, sometimes without core, but echinated by similar spined styles usually half immersed in the keratode; foreign bodies present in the fibres and in the ground substance; with a dermal layer of oxeas.

Spicules. Megascleres.—Spined style, 130 × 11 $\mu$, straight, with short vertical prickles.

Dermal amphitornote, 165 × 5.5 $\mu$, usually more gradually attenuated at one end than at the other.

Microscleres.—Sigmas, abundant and varying greatly in size, the largest being 38 × 2 $\mu$, contort and with sharp points.

Isochele, 17.5 $\mu$ in length, tridentate, the central tooth being 5 $\mu$ in length; with strongly curved keel.

Locality A.—East London coast, 85 fms.

In one important point the new species differs from the typical *Clathria*, viz., in the absence of smooth styles forming a

core to the spongin fibres. If a core is present at all it is formed of spined styles or foreign bodies.

Toxas also are apparently absent.

The solitary specimen, which apparently has been cut in half, expands upwards from a contracted base to a height of 27 cm, the width of the piece being 20 cm., and the thickness of the wall 1.5 cm. Near the base the wall is perforated by a large hole.

### Genus **Stylostichon** (Topsent).

#### **Stylostichon involutum,** sp. n.

Plate V., Fig. 16. Plate VI., Fig. 17a-e.

Sponge forming a thick, firm but flexible, plate, growing from a narrow base and with its lateral edges coiled inwards. Surface presenting a finely hispid woolly appearance, this being due to plumose dermal tufts of oxeas and included foreign particles. Pores and oscules not visible.

Colour (in spirit) brown.

Skeleton composed of branching plumose columns diverging obliquely from the central plane, and composed of spined styles echinated by smaller spined styles. Dermal skeleton composed of fan-shaped tufts of oxeas at the summits of the plumose columns.

Spicules. Megascleres. — Large style, $360 \times 24\ \mu$, slightly curved near the base, spined at the lower third, the thorn-like spines pointing backwards.

Small echinating style, $120 \times 6\ \mu$, with a marked bend at an angle of $45^{\circ}$ at the basal end, spined at the lower half.

Oxea of dermal skeleton, $1010 \times 8\ \mu$, straight, slender, fusiform.

Microscleres.—Large sigma, $120 \times 4\ \mu$.

Locality E.—Off Cone Point, Natal, 34 fms.; bottom, broken shells.

The specimen representing the new species is 8 cm. high, and 8 cm. wide, the wall being 2 cm. thick.

The species is distinguished by its peculiarly arranged ectosomal skeleton.

### Genus **Histoderma** (Carter).

#### **Histoderma natalense,** sp. n.

Plate V., Fig. 17. Plate VI., Fig. 18a-e.

Sponge small, bulbous, free or attached, with cylindrical tubular oscules, with a smooth and firm cortex inclosing a soft pith. Colour, white.

Skeleton. — Cortex formed of alternating transverse and longitudinal layers of amphityles, these latter also being scattered in the soft tissues.

Spicules. Megascleres. — Amphityle, 530 × 22 μ, smooth, curved; with long oval head 28 μ long, and 14 μ broad.

Acanthoxea (rare), 200 × 44 μ, slightly curved, fusiform, sharp-pointed, smooth at the ends, but with pyramidal spines on each side of the middle line directed towards the middle.

Microscleres. Sigma, 38 × 3.5 μ, contort smooth.

Isochele, tridentate, 20 μ long.

Trichites, rarely joined into trichodragmas, 275 μ long.

Spined coiled microsclere, 11 μ by 4 μ in total breadth; and spined cruciate form (fig. 18e).

Locality C.—Off Tugela River mouth, Natal, 65-80 fms.; bottom, hard ground.

There are two specimens of the new species, one attached by one of its tubular processes to a worm tube, the other free.

The free specimen is 11 μ in total length, it possesses 4 oscular distinct tubes and indications of 4 others; the size of the largest tube is 3 × 1 mm.

This species is near *Histoderma appendiculatum*, Cr., from the N. Atlantic, but there are distinct specific differences. The acanthoxeas and spined coils are absent in the Atlantic species, and the large styles occurring in the latter are not present in the Natal form; further, the other spicules common to both species vary greatly in size, as will be seen from the following table:—

| | Amphityles. | Isocheles. | Sigmas. |
|---|---|---|---|
| *H. appendiculatum* - | 1085 × 20 μ | 35 μ long | 132 × 5 μ. |
| *H. natalense* - - | 530 × 22 μ | 20 μ long | 38 × 35 μ. |

Dendy's supposition [6, p. 26] that *Siderodermá*, Ridley and Dendy, is identical with *Histoderma*, is undoubtedly correct.

The microscleres, which I have termed spined coils, at first seemed to me to be spined spirulae, but they are possibly modified sigmas. They resemble in some measure the spined isocheles of *Leptosia schmidti*, Topsent [19, pp. 232, 250, fig. 2b].

### Genus **Dendoryx** (Gray).

### **Dendoryx incrustans** (Esper).

1805–1830. *Alcyonium incrustans*, Esper [9, *Alcyonium*, tab. xv.].

1842. *Halichondria incrustans*, Johnston [10, p. 122, pl. xii., fig. 3; and pl. xiii., fig. 5].

1866. *Halichondria incrustans*, Bowerbank [2, ii. p. 249, iii. p. 107, pl. xliv., figs. 7-12].

1894. *Dendoryx incrustans*, Topsent [17, p. 13].

The sponge forms an irregular incrustation round the stem of a large Hydroid. The ectosomal spicules are all amphi-

tornote, and not styles with a tornote point such as Bowerbank figures.

The specimen is crowded in parts with small developing seed-like embryos, solitary or in clusters, each coated with a special layer of spined styles, more slender and less spined than the spicules of the general network.

Locality B.—Cape St. Blaize, 45 fms.; bottom, fine sand.

Distribution.—Great Britain, West Indies, South Africa, Falkland Islands.

### Genus **Desmacidon** (Bowerbank).

### **Desmacidon ramosum** (Ridley and Dendy).

1886. *Desmacidon* (?) *ramosa*, Ridley and Dendy [14, p. 346].
1887. *Desmacidon* (?) *ramosa*, Ridley and Dendy [15, p. 107, pl. xxiii. fig. 4-4c, pl. xxiv. fig. 4, pl. xlvii. fig. 6].

One small cylindrical fragment.

Locality C.—Off Tugela River mouth, 65-80 fms.; hard ground.

Distribution.—South of Cape of Good Hope, 150 fms., and Marion Island, 50-75 fms. ("Challenger").

The collection contains one small cylindrical fragment. Although the skeleton approximates more to a radial than to a reticulate type, yet a certain amount of reticulation is present; accordingly the specimen is here definitely placed in the genus *Desmacidon.*

### **Desmacidon grande** (Ridley and Dendy).

1886. *Homoeodictya grandis*, Ridley and Dendy [14, p. 347].
1887. *Desmacidon grandis*, Ridley and Dendy [15, p. 111, pl. xxii., pl. xxix., figs. 7, 7a].

This collection includes a fine series of specimens of this species, showing interesting variations in form.

All expand from a short thick rounded stem into a thin soft flabellate growth. In some the flap is entire, in others the margin is continued into flat digitate flaps longer than the undivided basal portion.

The largest specimen is 40 cm. high and 32 cm. broad.

The type specimen obtained by the "Challenger" from Simon's Bay has a much smoother surface and more clearly defined oscules than any of the present series, the surfaces of which are strongly tufted. A well-marked umbo is usually (and not exceptionally) present at the centre of the concavity of the keel of the isocheles in Dr. Gilchrist's specimens.

Localities A, B.—East London coast, 85 fms.; Cape St. Blaize, 45 fms.; bottom, fine sand; Simons Bay, 10-20 fms. ("Challenger").

Genus **Hamacantha** (Gray)

**Hamacantha esperioides** (Ridley and Dendy).

*Vomerula esperioides*, Ridley and Dendy [14, p. 337].
*Vomerula esperioides*, Ridley and Dendy [15, p. 60, pl. xii. fig. 1, pl. xvii. figs. 2, 4, 12].

One large conical specimen resembling in size and shape the type specimen, figured in the Challenger Report (*loc. cit.*)

Locality.—South-east of Cape Colony, 47 fms.

Distribution.—Agulhas Bank, 150 fms, and off Rio de la Plata, 600 fms. ("Challenger").

## Sub-Family **Renierinæ.**

Genus **Phlœodictyon** (Carter).

**Phlœodictyon eumatum,**[1] sp. n.

Plate V., Fig. 18. Plate VI., Fig. 19a, b.

Sponge club-shaped, with expanded, flattened upper end, presenting several circular oscules, each subdivided by partitions and with raised rims.

Consistence firm. Surface smooth. Colour dark brown.

Skeleton consisting of a central loose network of slender spiculo-fibre surrounded by a hard rind, and with a dermal layer of tangential oxeas not united into bundles; loose scattered oxeas in the choanosome.

Spicules. — Oxea, $190 \times 9\ \mu$, slightly curved, terminating abruptly in sharp points.

Locality E.—Off Cone Point, Natal, 34 fathoms; bottom, broken shells.

The one specimen representing this species is 6 cm. high, 2 cm. in diameter at the base, and 5 cm. in diameter at the flat summit. The specimen, which apparently has been torn from its attachment, reveals a loose network in the interior; the torn skeleton fibres form long loose shreds. There are three oscules with rims, the largest being 6 mm. in height, 10 mm. in diameter, and with nine circular sub-divisions; some smaller oscules are almost flush with the surface.

The new species is near *P. cohærens*, Carter [5, p. 446], from Port Phillip, but the latter is narrower at the summit than at

---

[1] εὔμιτος, with fine threads.

the base, the oscules are all level with the surface, and the oxeas blunt-pointed and only 145 × 6 $\mu$.

Lundbeck [13, p. 56] abolishes Carter's group Phœodictyinæ, placing the genus *Phlœodictyon* (of which *Rhizochalina* in the sense of later authors than Schmidt is a synonym) under Renierinæ near *Petrosia*. In the preliminary examination of the specimen I had labelled it *Petrosia*.

Genus **Pellina** (Schmidt).

**Pellina**, sp.

A small damaged funnel-shaped specimen 5 cm. in length, and 2.5 cm. in diameter at the summit, of brownish colour uniformly speckled with light grey spots. There is a well marked dermal membrane with oval meshes 370 × 310 $\mu$, the pore areas being in the meshes.

The skeleton is formed of rectangular meshes about 300 × 150 $\mu$, the long strands being about 10 spicules thick, and the short transverse strands 2 or 3 spicules thick.

The spicules are oxeas, 165 × 6.5 $\mu$, curved at the centre, and tapering gradually to sharp points.

Locality C.—Off Tugela River mouth, 65-80 fathoms; hard ground.

Genus **Halichondria** (Fleming).

**Halichondria pachastrelloides** (Topsent).

1892. *Halichondria pachastrelloides*, Topsent [16, p. 66, pl. ix. fig. 3].

I have little hesitation in identifying with the above species two massive specimens, the larger of which is 10 cm. long, 5 cm. high, and 6 cm. broad. One specimen, in spirit, is of a rich yellow colour in section, the other in formalin is greenish.

The oxeas vary from 150 × 4 $\mu$ to 700 × 28 $\mu$, and have a slight bend in the centre. Both specimens are encrusted by *Bubaris reptans mihi*.

Locality E.—Cone Point, Natal, 34 fathoms; bottom, broken shells.

Distribution.—Azores, 401 fathoms; Natal, 34 fathoms.

Genus **Coscinoderma** (Carter).

**Coscinoderma concentricum**, sp. n.

Plate VI., Fig. 19, 19a.

Sponge bowl-shaped, with a short thick stem.

The surface covered with a thin cortex, 60 $\mu$ thick, composed chiefly of sand particles; the cortex on the outer surface being

finely reticulated with the pores in the meshes, that on the inner surface (in the few places where it had not become eroded) being smooth and apparently imperforate.

On the outer surface slightly raised longitudinal ridges of oscules, two-deep, radiating up from base to edge and branching dichotomously; on the inner surface several concentric ridges of oscules, the latter also being arranged two-deep.

Texture firm but compressible, and soft and elastic in water.

Colour in dry state greyish-white where the cortex persists; skeleton dark amber brown.

Skeleton (as in *Euspongia*). Main fibres filled with sand grains and spicules, rather knotted and irregular, 60-100 $\mu$ thick, radiating in fan-like manner from central plane to surface, about 1 mm. distant from each other at the surface, and with irregular meshes about 0.4 mm. in diameter between the main fibres.

Secondary fibres, about 30 $\mu$ in diameter, without foreign particles, and with only a thread-like axial core.

Locality J.—Lat. 33° 53′ S., long. 25° 51′ E.; 30 fathoms; bottom, mud, sand and specks.

There are two dried specimens, the larger being 16 cm. high, 16 × 28 cm. in diameter at the mouth, and in the cavity of the cup 13 cm. deep; the stalk is 2.5 cm. long, and the wall 1 cm. thick.

The second specimen is much smaller and worn into holes.

The concentric oscular ridges on the inner surface do not form complete circles; the ridges are about 8 mm. high, and 10 mm. broad at the base, the oscules being each about 1 mm. in diameter. The shape of the specimens and the presence of the concentric ridges on the inner surface recall the *Spongia agaricina*, var., figured by Esper [8, p. 206, pl. lix.], from Surinam.

The existence of the fine sandy cortex seems to me sufficient to exclude this form from *Euspongia*. Lendenfeld observes [11, p. 227] that a dense cortex is never present in this genus. Other characters which Lendenfeld attributes to *Coscinoderma*, such as the existence of "large continuous sub-dermal cavities without vestibular spaces," I have not been able to make out in the dried specimens. The comparatively small size of the meshes and of the axial core of the fibres excludes this species from *Thorecta*.

### Genus **Stelospongia** (Schmidt).

#### **Stelospongia,** sp.

Sponge pyriform. Colour, where covered by dermal membrane, pale grey; colour of skeleton, brown. Conuli, from

3-4 mm. high, arranged in spiral lines, with grooves 3 mm. wide between the lines. Oscules, numerous, about 2-2.5 mm. in diameter, opening obliquely in the grooves. Pore areas, .5 mm. in diameter in the meshes of a dermal reticulum. Main fascicles of skeleton, 1-1.5 mm. in diameter; diameter of separate fibres 35 $\mu$, a second more slender kind being only 13 $\mu$.

Locality D.—Cape Vidal, Natal, 80-100 fathoms; bottom, rock.

The species is probably new, its chief characters being the spiral grooves containing the many small oscules.

The pyriform varieties of *S. australis*, Lendenfeld, differ from the present form in having a single large osculum.

The specimen is 8 cm. high, and 5 cm. broad at the broadest part.

In the hope that more specimens will be obtained, I have not given a name to the species.

### Genus **Hircinia** (Nardo).

#### **Hicinia arenosa** (Lendenfeld).

1889. *Hircinia arenosa*, Lendenfeld [11, p. 583, pl. xxxvi. fig. 3].

There are two specimens of this species, one being small and cup-shaped, the other forming a large saddle-shaped mass 20 cm. in height, 19 cm. in width, and varying from 4 to 7 cm. in thickness. The pore areas are on the under or outer, and the small circular oscules on the upper or inner surface. Colour, brownish pink.

The skeleton is formed of a central layer giving off on each side parallel main fibres running obliquely to the surface; the secondary fibres form a double row of narrow elongated meshes between the main fibres. The main fibres are cored with large sand grains, the secondary fibres being free of foreign particles, excepting that one sand particle is situated at each central node of the secondary meshes.

The filaments are 6 $\mu$ broad, the oval heads being 16.5 long by 11 $\mu$ broad. The ciliated chambers are 27 $\mu$ in diameter, and nearly spherical.

Locality A.—East London coast, 85 fathoms.

Distribution.—W., S., and E. coasts of Australia; South Africa.

#### **Hircinia arbuscula** (Lendenfeld) [11, p. 571].

Plate VI., Fig. 20, 20a, b, and Plate VII., Fig. 20.

There are eight specimens of this species. The colour in spirit is yellow, and the consistence firm but compressible; in

the dry state the colour is dirty white, and the consistence hard and leathery. The specimens vary considerably, four being single, and four multiple; the former are smooth and swollen at the lower half, and terminate in a conical tube with conulated surface, and with an oscule at the summit. The multiple specimens have from two to five oscular tubes rising from the fused basal portion. The largest specimen has a massive subglobular base 8 cm. in diameter, with two cones, each 7 cm. in length. The whole surface is covered with a very fine sandy layer, which clothes also the main ex-current canal passing from base to summit. The conules (1-2 mm. high) cover the whole surface in some specimens, but only the upper part in others. The finely reticulate poral area (with meshes 100 $\mu$ in diameter) is either sharply limited to the upper half or extends over nearly the whole surface. The skeletal scaffolding, which conforms more or less to the shape of the specimens, consists of vertical main fascicles of fibres (350 $\mu$) extending from base to summit, and joined web-like layers of horny network. Sometimes the fascicles and single fibres are accompanied by lines of foreign spicules, and occasionally the latter form a core in the centre of the fascicles or the fibres themselves. Fibres vary from 15-60 $\mu$ in diameter, and are usually free of foreign bodies.

The filaments, which form a fasciculated network in the body and a felt-like layer beneath the cortex, are wavy, 2.75 $\mu$ wide, with pyriform heads $11 \times 5.5$ $\mu$ in diameters; these bodies are thicker (6 $\mu$) and with more globular heads in the Australian specimens, and the brown spots present in the latter do not occur in the South African specimens.

Localities.—C. Tugela River mouth, 65-80 fathoms; bottom, hard ground. D. Cape Vidal, Natal, 80-100 fathoms; bottom, rock. G. O'Neil Peak, Natal, 55 fathoms; bottom, broken shells.

Distribution.—Port Phillip and Port Jackson, Australia; Natal.

### Genus **Psammopemma** (Marshall).

#### **Psammopemma inordinatum,** sp. n.

Plate VI., Fig. 21, 21a.

Sponge massive, hemispherical, attached by a flat base. Surface rendered irregular by numerous foreign bodies beneath the dermal membrane. Dermal membrane smooth, but with irregularly shaped finely reticulate poral areas. Small circular oscules, few in number, 1-2 mm. in diameter, flush with the surface.

Colour (in spirit) grey, with a faint pink tinge.

Skeleton consisting of confused masses of various kinds of foreign bodies (pieces of shell, Polyzoa, lumps of sand, etc.), without areniferous fibres. The ground substance crowded with large spherical cells, 12 $\mu$ in diameter, loaded with granules.

Localities C and D.—Off Tugela River mouth, 65-80 fathoms, hard ground; and off Cape Vidal, Natal, 80-100 fathoms, rock.

There are two specimens of this species. The larger, which has been torn from its attachment, is 6 cm. in its basal diameter, and 4 cm. in height. The smaller specimen is a nodule growing on *Hircinia arbuscula*, Lendenfeld.

On section little else is seen but a mass of shells, sand, etc. The flagellated chambers are large and nearly spherical, averaging about 33 $\mu$ in diameter; but they are often distorted by pressure, one for instance being oval and measuring $55 \times 17.5\ \mu$.

# LIST OF LOCALITIES.

A. No. 907. From East London coast, Lat. 33° 6′ 30″ S., Long. 28° 11′ E., with dredge. Depth, 85 fathoms.

B. No. 1264. Cape St. Blaize bearing N.E. by E., 27½ miles, with large trawl. Depth, 45 fathoms. Bottom, fine sand.

C. No. 11340. Tugela River mouth bearing N.W. by N. ¼ N., 24 miles, with large dredge. Depth, 65-80 fathoms. Bottom, hard ground.

D. No. 11958. Cape Vidal, Natal coast, bearing N.N.E. ¼ N., 9½ miles, with dredge. Depth, 80-100 fathoms. Bottom, rock.

E. F. Nos. 12014. Cone Point, Natal coast, bearing N.W. ½ W., 4 miles, with dredge. Depth, 34 fathoms. Bottom, broken shells.

G. No. 12095. O'Neil Peak, Natal coast, bearing N.N.W. ¼ W., 8 miles, with dredge. Depth, 55 fathoms. Bottom, broken shells.

H. No. 12553. Cape Natal bearing W. by N. ¾ N., 11 miles, with shrimp trawl. Depth, 185-200 fathoms. Bottom, sand and mud.

J. No. 707. Lat. 33° 53′ S., Long. 25° 51′ E. 30 fathoms. Bottom, mud, sand and specks. By dredge.

K. Nos. 12162. Durnford Point, Natal, bearing N.W. ¾ W., 12 miles. Depth, 90 fathoms. Bottom, broken shells.

L. No. 12713. East London bearing N.W. ½ N., 18 miles. Depth, 250-300 fathoms. Bottom, broken shells.

## INDEX OF LITERATURE.

---

1. Bocage, Barboza du. Éponges silicieuse nouvelles de Portugal et de l'Ile Saint Jago. "Journ. Sci. Math. Phys. e Nat.," Lisboa. 1871. Vol. II.

2. Bowerbank, J. S. Monograph "British Spongiadæ." 1864-1874.

3. ———— Report on a Collection of Sponges found at Ceylon. . . . "Proc. Zool. Soc.," Lond. 1873.

4. Carter, H. J. Supplementary Report on specimens from Gulf of Manaar and Bass's Straits. "Ann. and Mag. N. H." 1881. (5) VII.

5. ———— Sponges from S. Australia. "Ann. and Mag. N. H." 1886. (5) XVIII.

6. Dendy, A. Catalogue of Non-Calcareous Sponges. . . . Port Phillip Heads. "Proc. Roy. Soc.," Vict. 1896. VIII., n.s., Part ii.

7. ———— Id. 1897. IX., n.s.

8. Esper, E. J. C. "Fortsetzungen du Pflanz." Part i. 1797.

9. ———— "Pflanzenthiere." Part iii. 1805-1830.

10. Johnston, G. "A History of British Sponges and Lithophytes." 1842.

11. Lendenfeld, R. von. "Monograph of Horny Sponges." 1889.

12. ———— "Spongien von Sansibar. Abhand. Senckenberg Nat. Gesellsch." 1897. Bd. XXI.

13. Lundbeck, W. "The Danish Ingolf Expedition (Copenhagen)." 1902. Vol. VI. Porifera, Part i.

14. Ridley and Dendy. Preliminary Report, "Challenger, Monaxonida. "Ann. and Mag. N. H." 1886. (5) XVIII.

15. ———— "Challenger" Report, Monaxonida. 1887.

16. Topsent, E. "Contribution a l'Étude des Spongiaires de l'Atlantique Nord. Monaco." 1892.

17. ———— Une reforme dans la classification des Halichondrina. "Mem. Soc. Zool. France." Vol. VII. 1894.

18. ———— Classification des Hadromerina. "Archiv. Zool. Exp." Série 3, Tom. VI. 1898.

19. ———— Éponges nouvelles des Açores. "Mem. Soc. Zool. France." XI. 1898.

# EXPLANATION OF PLATES.

## Plate V.

Fig. 1.—*Placospongia labyrinthica*, sp. n., showing oscular areas, the large poral surface being on the opposite side, × ½; 1*b*, poral surface, × 1.

Fig. 2.—*Latrunculia natalensis*, sp. n., × 2.

Fig. 3.—*Kalastrella vasiformis*, sp. n., × 1.

Fig. 4.—*Kalastrella vasiformis*, var. *minor*, × ½.

Fig. 5.—*Coppatias baculifer*, sp. n., on *Stelletta horrens*, Kirkp., × ½.

Fig. 6.—*Tethya magna*, sp. n., × ½; 6*a*, poral areas, × 2.

Fig. 7.—*Trachya nuda*, sp. n., × ½.

Fig. 8.—*Hymeniacidon caliculatum*, sp. n., × ⅓.

Fig. 9.—*Phakellia microxephora*, sp. n., × ½.

Fig. 10.—*Tragosia infundibuliformis*, var. *natalensis*, var. nov., × ½.

Fig. 11.—*Syringella gorgonioides*, sp. n., Fragment, × 1.

Fig. 12.—*Axinyssa tethyoides*, sp. n., × ½.

Fig. 13.—*Sigmaxinella arborea*, sp. n., × ½.

Fig. 14.—*Bubaris reptans*, sp. n., on *Halichondria pachastrelloides*, Topsent, × ½; Fig. 14*a*, a small piece, from a specimen preserved in formalin, showing oscular (and poral ?) papillæ, × 2.

Fig. 15.—*Clathria mollis*, sp. n., × ⅓.

Fig. 16.—*Stylostichon involutum*, sp. n., × ½.

Fig. 17.—*Histoderma natalense*, sp. n., × 2; 17*a*, portion of another specimen attached to worm tube, × 2.

Fig. 18.—*Phlœodictyon eumitum*, sp. n., × ½.

Fig. 19.—*Coscinoderma concentricum*, × ⅓; 19*a*, sandy cortex from outer surface showing poral areas, × 4.

Fig. 20.—*Hircinia arbuscula*, × ½; 20*a*, section, × ½; 20*b*, cortex at junction of poral and imperforate surface, × 4.

Fig. 21.—*Psammopemma inordinatum*, × ½; 21*a*, ditto., poral area, × 5.

## Plate VI.

Fig. 1.—*Placospongia carinata*: *a*, subtylostyle, × 80; *b*, strongyle, × 80; *c*, oxea, × 80; *d*, sterrasters, × 80, with sketches showing development of ends of actines; *e*, somal chiaster, × 730; *f*, pycnaster, × 730.

Fig. 2.—*Latrunculia natalensis*: *a*, strongyle, × 80; *b*, tornote, × 80; *c*, *c'*, curved and straight styles, × 80; *d*, *d'*, discaster, side and end view, × 730; *e*, choanosomal discaster, × 730.

Fig. 3.—*Kalastrella vasiformis*: *a*, strongyle, × 80; *b*, oxea, × 80; *c*, style, × 80; *d*, thick straight style, very rare, × 80; *e*, small tyle or subtylostyle, × 420; *f*, euasters, × 730.

Fig. 4.—*Kalastrella vasiformis*, var. *minor.*: *a*, oxea, × 80; *b*, style, × 80; *c*, small tyle, × 420; other spicules as in Fig. 3.

Fig. 5.—*Coppatias baculifer*: *a*, *a'*, oxeas, × 80; *b*, microstrongyles, × 730.

Fig. 6.—*Tethya magna*: *a*, strongyloxea, × 80; *b*, cortical spheraster, × 730; *c*, somal chiaster, × 730; *d*, choanosomal aster, × 730.

Fig. 7.—*Trachya nuda*: *a*, vertical section, × 5; *b*, oxea, × 80.

Fig. 8.—*Axinyssa tethyoides*: *a*, branching skeleton fibres, × 5; *b*, oxea, × 80.

Fig. 9.—*Phakellia microxephora*: *a*, vermicular strongyles, × 80; *b*, style, × 80; *c*, oxea, × 80; *d*, microxea, × 80.

Fig. 10.—*Tragosia infundibuliformis*, var. *natalensis*: *a*, ectosomal skeleton network, × 5; *b*, style, × 80; *c*, oxea, × 80; *d*, *e*, style and oxea from Johnston's type, × 80.

Fig. 11.—*Syringella gorgonioides*: *a*, transverse section of a small twig, × 2; *b*, style, × 80.

Fig. 12.—*Hymeniacidon caliculatum*: styles, × 80.

Fig. 13.—*H. caliculatum*, var. *osculatum*: styles, × 80.

Fig. 14.—*Sigmaxinella arborea :* *a*, *a'*, styles ; *b*, strongyle ; *c*, oxea ; *d*, rhaphides—all × 80 ; *d'*, *d''*, rhaphides, × 730 ; *e*, sigmas, × 730.

Fig. 15.—*Bubaris reptans :* *a*, vertical section, × 6 ; *b*, style, × 80 ; *c*, tyles, × 80.

Fig. 16.—*Clathria mollis :* *a*, spined style, × 80 ; *a'*, the same, × 420 ; *b*, dermal oxea, × 80 ; *b'*, the same, × 420 ; *c*, sigma, × 730 ; *d*, *d'*, tridentate isochele, side and front view (the web extending from tooth to shaft, not from tooth to tooth), × 730.

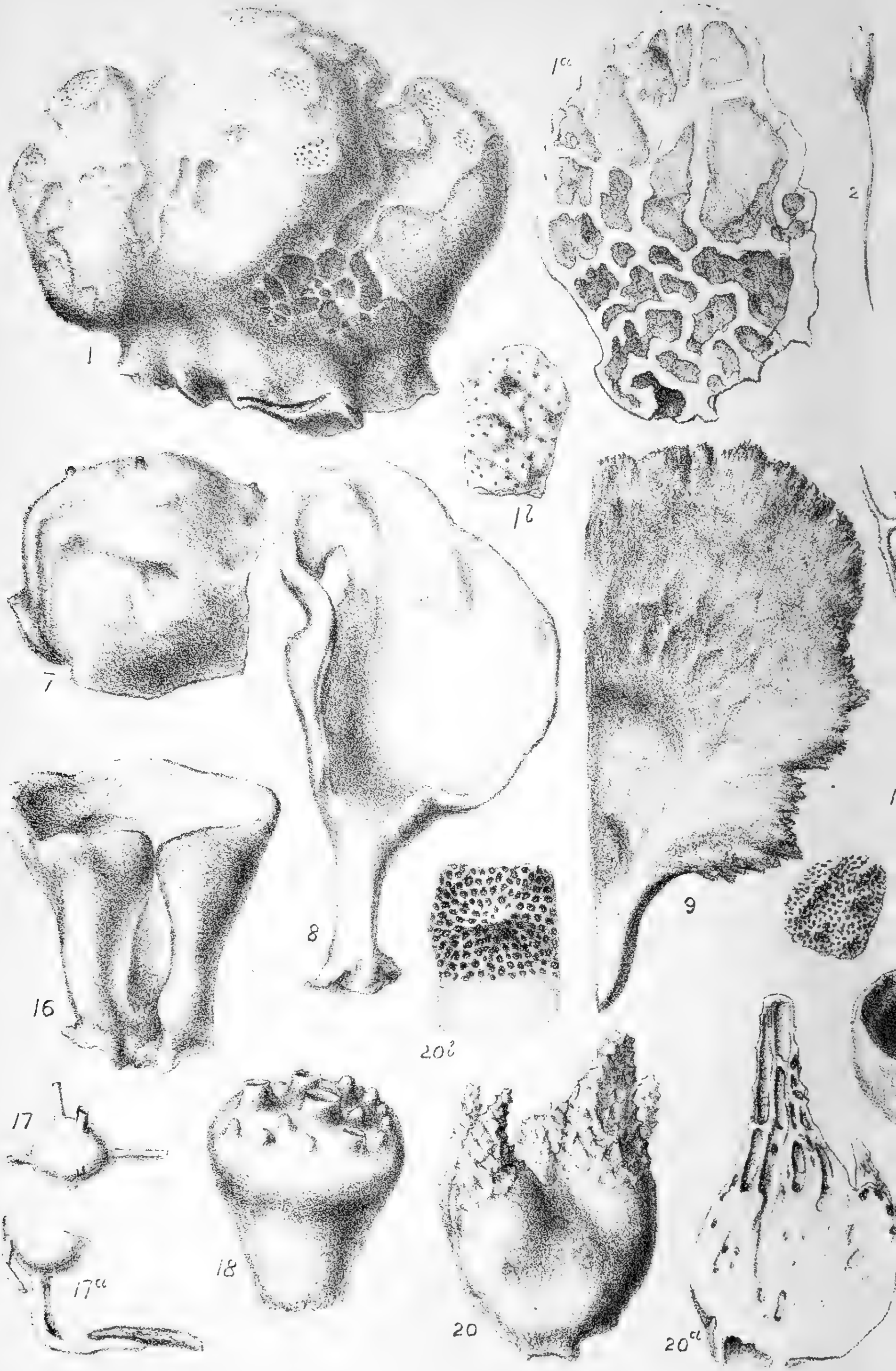
Fig. 17.—*Stylostichon involutum :* *a*, vertical section showing plumose columns and superficial layer of tufts of oxeas ; *b*, central styles, × 80 ; *c*, echinating styles, × 80 ; *d*, dermal oxea, × 80 ; *e*, sigma, × 730.

Fig. 18.—*Histoderma natalense :* *a*, amphitylotes, × 80 ; *b*, acanthoxea, × 80 ; *b'*, the same, × 200 ; *c*, sigma, × 730 ; *d*, tridentate isochele, side view, × 730 ; *e*, spined, coiled and cruciate spicules, × 730.

Fig. 19.—*Phlœodictyon eumitum :* *a*, network of skeletal fibres, × 5 ; *b*, oxeas, × 80.

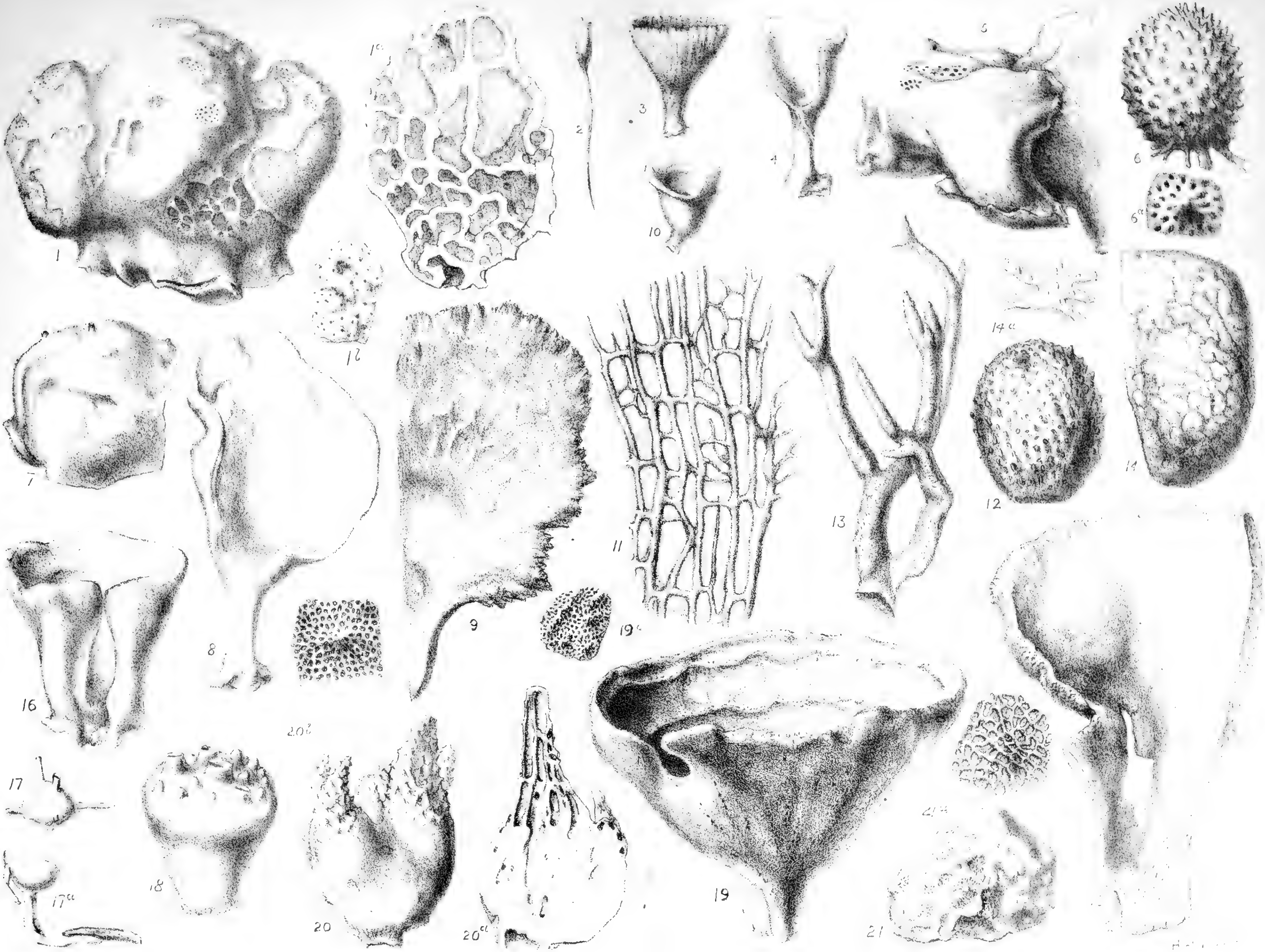
Fig. 20.—*Hircinia arbuscula :* main fascicle and web-like network, × 50.

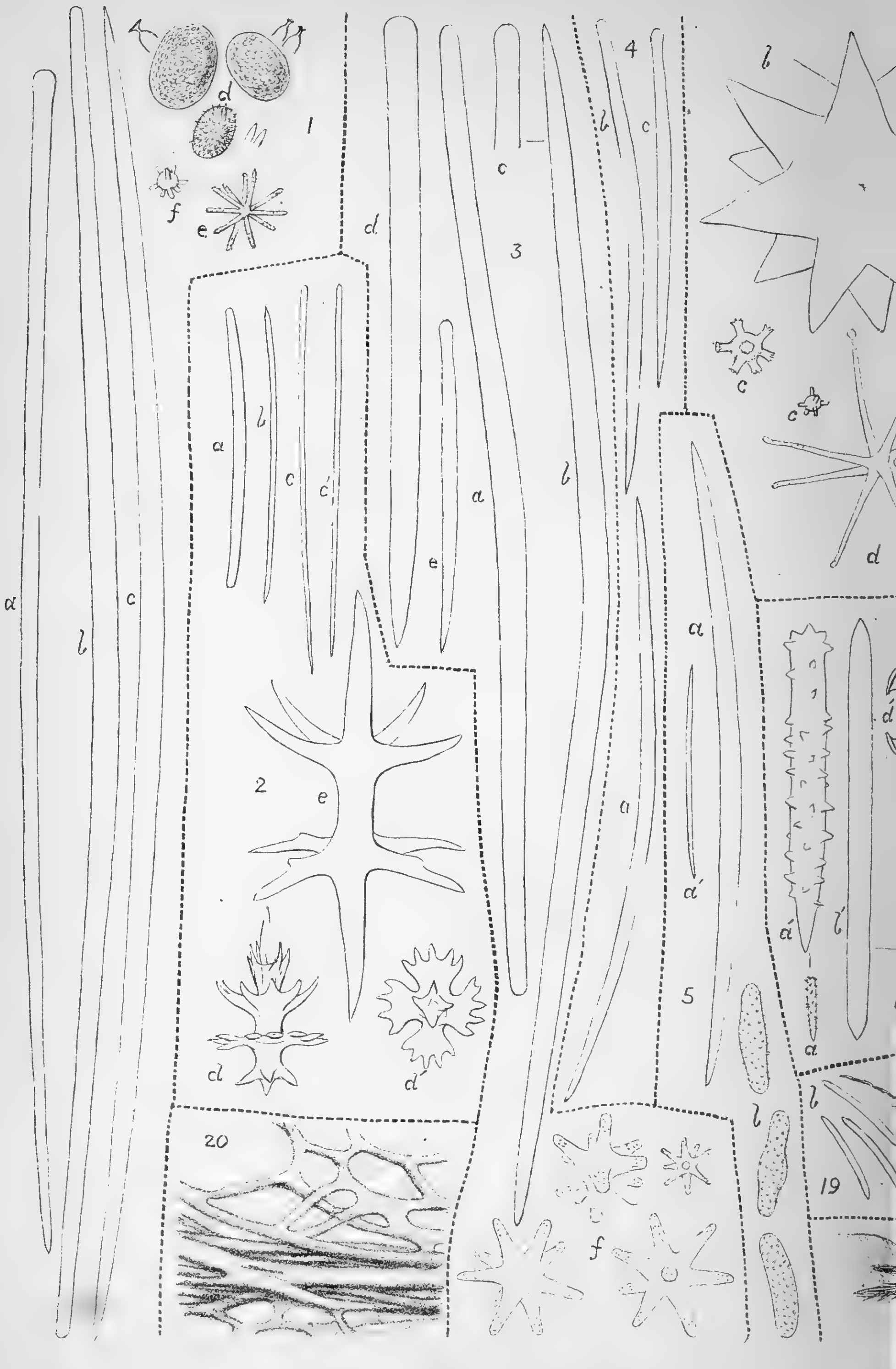
[Published 21st July, 1903.]


1ª
2
1
1b
7
9
8
16
20b
17
17ª
18
20
20ª

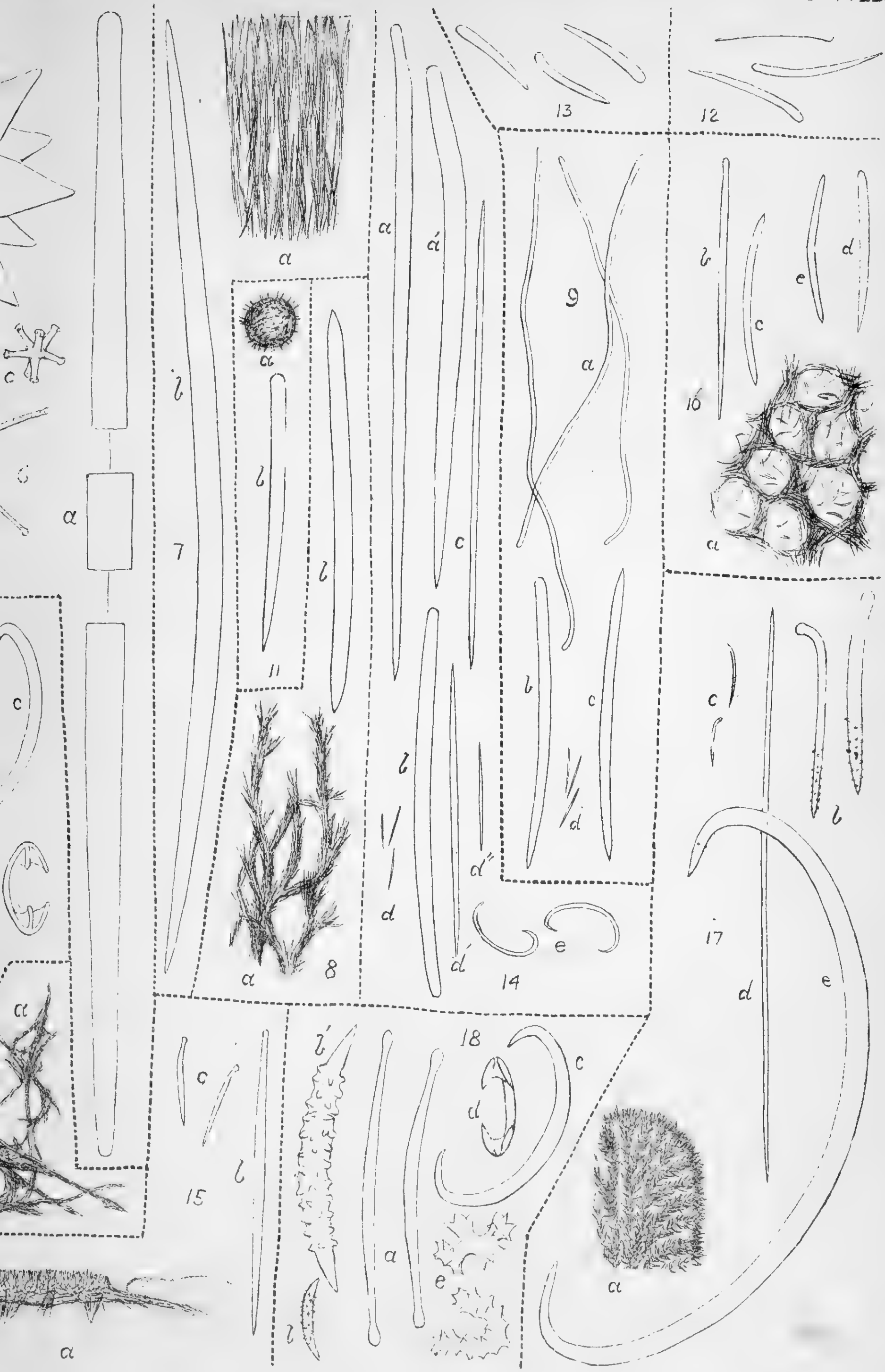
Pl. V.

Pl. V.


1
1a
1b
2
3
4
5
6
6a
7
8
9
10
11
12
13
14
14a
16
17
17a
18
19
19a
20
20a
20b
21
21a


1
2
3
4
5
19
20

Sponges. Pl. VI.




Highley del. et lith.

Highley del et lith

# INDEX.

## CRUSTACEA.

*(For names of genera and species see author's index, pp. 91, 92.)*



## MOLLUSCA.

The names in italics are either synonyms, or genera and species referred to for comparison.

## Mollusca—*continued.*



## FISHES.

## Fishes—*continued.*

## Fishes—*continued.*



## CORALS.



## SPONGES.

## Sponges—*continued.*

## CORRIGENDA TO VOL. II.

---

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Page | 3, | line | 8, | for | Epitome, | read | Epistome. |
| ,, | 7, | ,, | 32, | ,, | Dolflein, | ,, | Doflein. |
| ,, | 9, | ,, | 24, | ,, | Herbat, | ,, | Herbst. |
| ,, | 10, | ,, | 10, | ,, | Lonchester, | ,, | Lanchester. |
| ,, | 12, | ,, | 39, | ,, | *Xavia*, | ,, | *Xaiva.* |
| ,, | 13, | ,, | 37, | ,, | *bypunctulatus*, | ,, | *bipunctulatus.* |
| ,, | 15, | ,, | 32, | ,, | 1873, | ,, | 1893. |
| ,, | 15, | ,, | 30, | ,, | *bisponosa*, | ,, | *bispinosa* (twice). |
| ,, | 16, | ,, | 10, 12, | ,, | *bisponona* | ,, | *bispinosa.* |
| ,, | 18, | ,, | 21, | ,, | Dé Cap, | ,, | Décap. |
| ,, | 18, | ,, | 30, | ,, | Dromiacæ, | ,, | Dromiaceæ. |
| ,, | 19, | ,, | 1, | ,, | Homoldromiidæ, | ,, | Homolodromiidæ. |
| ,, | 19, | ,, | 22, | | Insert date 1888. | | |
| ,, | 24, | ,, | 4, 8, | ,, | Latreillia, | ,, | Latreillea. |
| ,, | 38, | ,, | 4, | ,, | Liniparus | ,, | Linuparus. |
| ,, | 38, | ,, | 5, | ,, | *Serex* | ,, | *Senex.* |
| ,, | 41, | ,, | 21, | ,, | *amboinencis*, | ,, | *amboinensis.* |
| ,, | 46, | ,, | 29, | ,, | *Duvancellii*, | ,, | *Duvancelii.* |
| ,, | 46, | ,, | 30, | ,, | Erichthus, | ,, | *Erichtus.* |
| ,, | 49, | ,, | 20, | ,, | *magara*, | ,, | *mayana.* |
| ,, | 49, | ,, | 26, | ,, | *Calopisthus*, | ,, | *Colopisthus.* |
| ,, | 57, | ,, | 1, | ,, | Krauss, | ,, | (Krauss). |
| ,, | 61, | ,, | 37, | ,, | Gamanaridea, | ,, | Gammaridæ. |
| ,, | 76, | ,, | 12. | ,, | *Cypromiscus* | ,, | *Cyproniscus.* |
| ,, | 78, | ,, | 28, | ,, | W., in | ,, | W. that on. |
| ,, | 78, | ,, | 29, | ,, | 84 | ,, | 8·4. |
| ,, | 79, | ,, | 15, | ,, | Crosophorus | ,, | Crossophorus. |
| ,, | 92, | ,, | 9, | ,, | Gonoplan, | ,, | Gonoplax. |
| ,, | 92, | ,, | 22, | ,, | Sphæsomidæ, | ,, | Sphæromidæ. |
| ,, | 189, | | | ,, | verrucosus, | ,, | spinifer. |
| ,, | 201, | | | ,, | torvus, | ,, | ,, |